



**United States Military Academy  
West Point, New York 10996**

**RESEARCH PLAN**

OF THE

**OPERATIONS RESEARCH CENTER  
AND  
DEPARTMENT OF SYSTEMS ENGINEERING**

FOR THE

**ACADEMIC YEAR 2005**

**DTIC No. ADA-427015**

**Lietenant Colonel Michael J. Kwinn, Jr., Ph.D.**  
Director, Operations Research Center of Excellence

**Colonel Michael L. McGinnis, Ph.D.**  
Professor and Head, Department of Systems Engineering

**Brigadier General Daniel J. Kaufman, Jr., Ph.D.**  
Dean of the Academic Board, United States Military Academy

*The Operations Research Center is supported by the  
Assistant Secretary of the Army (Financial Management and Comptroller).*

**Distribution A: Approved for public release; distribution is unlimited.**

20041109 146

## **Table of Contents**

<b>EXECUTIVE SUMMARY</b>	<b>4</b>
<b>PART I – THE DEPARTMENT OF SYSTEMS ENGINEERING RESEARCH PROGRAM</b>	<b>5</b>
<b>PART II – THE OPERATIONS RESEARCH CENTER OF EXCELLENCE</b>	<b>6</b>
<b>PART III – FACULTY RESEARCH</b>	<b>7</b>
<b>PART IV – CAPSTONE RESEARCH</b>	<b>10</b>
<b>PART V – ACADEMIC INDIVIDUAL ADVANCED DEVELOPEMNT (AIAD)</b>	<b>10</b>
<b>PART VI – THE DEPARTMENT RESEARCH FOCUS</b>	<b>11</b>
<b>PART VII – THE DEPARTMENT RESEARCH CYCLE</b>	<b>11</b>
<b>PART VIII – RESEARCH ACTIVITIES FOR AY05</b>	<b>13</b>
<b>PART IX - AY 05 FACULTY RESEARCH PROGRAM</b>	<b>15</b>
<b>Simulation Roadmap for Program Executive Office (PEO) Soldier Programs.....</b>	<b>16</b>
<b>Operational Review for US Army Medical Materiel Center-Europe (USAMMCE) Reorganization.....</b>	<b>20</b>
<b>Army M&amp;S Terrain Database Catalogue (Baseline) and Future Framework .....</b>	<b>22</b>
<b>Shaping the ROTC Cohort .....</b>	<b>26</b>
<b>Organizational Analysis for the Installation Management Agency (IMA) .....</b>	<b>28</b>
<b>Hypersonic Projectile Mission Analysis.....</b>	<b>30</b>
<b>Aviation Readiness (Army Lead-the-fleet) .....</b>	<b>33</b>
<b>Support Leader's Digital Assistant (SLDA): A Tool for the Support Platoon Leader .....</b>	<b>37</b>

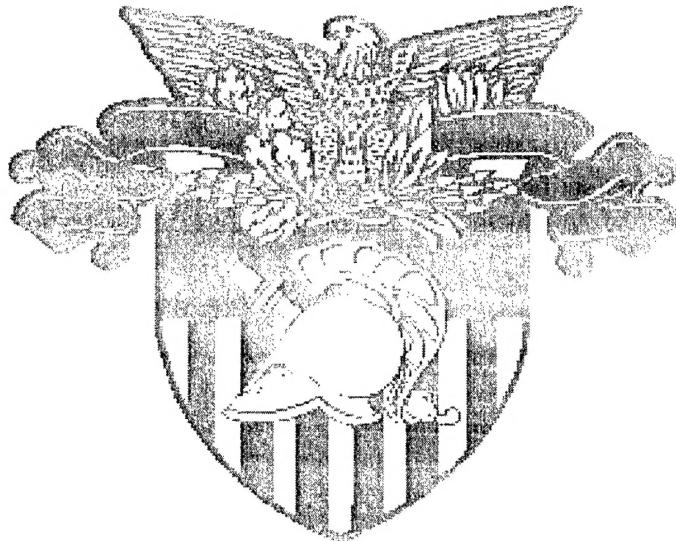
<b>Base Realignment and Closure (BRAC) 2005: Army Installation Military Value Portfolio Analysis .....</b>	<b>40</b>
<b>High Energy Laser Weapons: Modeling and Simulations.....</b>	<b>42</b>
<b>Selecting Portfolios of R&amp;D Projects .....</b>	<b>44</b>
<b>Information Quality &amp; Service Reliability .....</b>	<b>46</b>
<b>Logical Ontology to Assess Information Advantage.....</b>	<b>49</b>
<b>Using Agent Based Models (ABMs) to determine Soldier Tactical Mission System (STMS) Effectiveness.....</b>	<b>52</b>
<b>Applying Value-Focused Thinking to Effects Based Operations .....</b>	<b>54</b>
<b>Capabilities Based Readiness Metric .....</b>	<b>56</b>
<b>Computing Probability of Mission Planning and Execution Success .....</b>	<b>58</b>
<b>Blackboard Usage Analysis and Grades Correlation .....</b>	<b>60</b>
<b>Interleaving Discretization &amp; Learning to Improve Identification and Accuracy of Inference Estimates in Learning Networks.....</b>	<b>63</b>
<b>Development of a Data Collection Strategy In Support of PEO Soldier Simulations .....</b>	<b>65</b>
<b>National Academies Study on Complex Future of Models and Simulations (M&amp;S).....</b>	<b>68</b>
<b>Acquisition Modeling and Simulation Working Group (AMSWG) .....</b>	<b>71</b>
<b>Force Scheduling Decision Support Requirements .....</b>	<b>73</b>
<b>Validation Methodology for Human Behavior Representation Models .....</b>	<b>75</b>
<b>Distributed Sensor Network (DSN) Simulation Model .....</b>	<b>77</b>
<b>Tactical Ground Information Domain (T-GrID) Analytical Support .....</b>	<b>80</b>
<b>Command and Control (C2) Metrics for Small Unit Operations in Urban Environments .....</b>	<b>84</b>
<b>Base Camp Analysis: Location, Layout and In-Theatre Infrastructure Assessment 05 .....</b>	<b>87</b>
<b>Deployment Analysis and Decision Support, FY05 .....</b>	<b>90</b>
<b>Homeland Defense Crisis Response Research &amp; Readiness Center .....</b>	<b>92</b>

<b>Adaptive Virtual Analytical Test and Research (AVATAR) Environment.....</b>	<b>96</b>
<b>PART X - AY05 CAPSTONE RESEARCH PROGRAM</b>	<b>99</b>
<b>    Bandwidth Allocation Study for the Disposable, Air-droppable, Meteorological Tower Array (DAMTA).....</b>	<b>100</b>
<b>    Performing Verification and Validation Measures in Prioritizing Construction of Base Camp Facilities and Infrastructure.....</b>	<b>103</b>
<b>    A Study of Existing Technologies for Identifying and Assessing Urban Infrastructure/Infrastructure Recon for Urban Operations .....</b>	<b>107</b>
<b>    Feasibility Study on Automating Rules of Engagement in Fully Automated Target Engagement Systems.....</b>	<b>111</b>
<b>    Systems Modeling &amp; Analysis of Retread Supply Chain Operations .....</b>	<b>114</b>
<b>    Communications Model Analysis .....</b>	<b>117</b>
<b>    Integration of Systems Engineering Best Practices with DoD Acquisition Policy .....</b>	<b>120</b>
<b>    Simulation Studies to Support USMA R-Day Design.....</b>	<b>122</b>
<b>    Simulation Analysis Studies to Support PEO Soldier .....</b>	<b>125</b>
<b>    Hypersonic Flight Capability &amp; Its Use to Meet Army Missions &amp; Threats .....</b>	<b>127</b>
<b>    Evaluating the impact of a 10 to 1 increase in required supply chain deliveries .....</b>	<b>129</b>
<b>    Integrating Unattended Ground Sensors into the Force.....</b>	<b>131</b>
<b>    Transportation Safety &amp; Risk Assessment (TSRA), FY05 Capstone .....</b>	<b>133</b>
<b>    Bradley Medium Caliber Cannon Study .....</b>	<b>136</b>
<b>    Modeling Human Behavior in Synthetic Environments .....</b>	<b>138</b>
<b>    BCT Supportability Modeling .....</b>	<b>140</b>
<b>    Analysis of Alternatives for Arming UAVs (formerly UAV Support to the Company).....</b>	<b>142</b>
<b>PART XI - DISTRIBUTION LIST</b>	<b>144</b>

## **EXECUTIVE SUMMARY**

The purpose of this document is to formally present the research program of the *U.S. Military Academy Department of Systems Engineering (DSE) and the Operations Research Center for Excellence (ORCEN)* for the Academic Year 04-05. The research plan includes a statement of purpose for research which supports DSE and the ORCEN, a description of the two organizations, a list of the key personnel responsible for executing the plan, and an overview of the annual research cycle.

After this introduction, we present research summaries for applied research or problem-solving project, including Cadet Capstone Projects. Each summary includes a problem statement, a proposed methodology for project execution, project requirements and deliverables, estimates of milestones, and the number of man-years required to complete the work. Additional information is provided on the senior investigator, principal analyst or Capstone team, the client organization, and points of contact.



## **PART I – THE DEPARTMENT OF SYSTEMS ENGINEERING RESEARCH PROGRAM**

*The purpose of the research program within the Department of Systems Engineering is to support cadet education and faculty development through the organization, execution and presentation of relevant Army and Department of Defense research opportunities for significant clients.*

The Department of Systems Engineering research projects provide the faculty and cadets with the opportunity to investigate a wide spectrum of interdisciplinary, systemic issues and to apply many of the systems engineering, engineering management, and operations research concepts studied in the classroom to real-world problems of interest to the Army and the Department of Defense (DoD). These projects demonstrate for both cadets and faculty the relevance and importance of systems engineering in today's high-technology military.

The research program in the Department of Systems Engineering (DSE) directly addresses four specific Academy needs.

**1. Research enriches cadet education.** Cadets learn best when they are challenged and when they are interested. The introduction of current issues facing the military into their curriculum achieves both. Early in their education, cadets are taught by their instructors the application of techniques to real issues and problems – issues and problems they will face upon graduation. Through this, they gain an appreciation of the robustness of the discipline and a greater understanding of their profession. As they progress in their education, they begin to apply these techniques to heretofore unsolved issues and problems. This codifies their education on the techniques and instills a adaptive, problem-solving mentality in the cadets.

**2. Research enhances professional development opportunities for Army faculty.** It is important to develop and grow as a professional officer in each assignment. On the DSE faculty, officers conduct research on relevant projects to remain current in their operational branch or in the Functional Areas 49, 51, or 53. The research they conduct keeps them abreast of Army and DoD issues, at the forefront of their academic discipline and is returned to the classroom. They become better officers and leaders through the knowledge they gain and impart.

**3. Research maintains strong ties between the Academy and Army/DoD agencies.** The US Military Academy and DSE is a tremendous source of highly qualified analysts for the Army and DoD. Each faculty member holds an advanced degree in a technical discipline and has a deep understanding of the military and its issues. Research ensures that the Academy remains a significant part of the Army and DoD and not just another source of commissioning for junior officers.

**4. Research provides for the integration of new technologies into the academic program.** As the pace of technological advances increases, the Academy's education

program must not only keep pace but must lead to ensure our graduates and junior officers are prepared for their continued service to the Army. Research applying the most advanced technology and techniques is critical to achieving this objective.

By being fully engaged in current Army and DoD issues, the Department of Systems Engineering and the Operations Research Center assures that systems engineering education at USMA and our faculty remain current and relevant. The military's return on its investment, is meaningful career development experiences for officers, especially those in Functional Areas 49/51/53, an enhanced education program for the USMA cadets, and important investigation of vital Army and DoD problems at far less cost than would be required through civilian contracts.

There are four aspects to the research program within the Department of Systems Engineering: The Operations Research Center of Excellence, Faculty research, Cadet Capstone research and Academic Individual Advanced Development opportunities (AIADs). Though each aspect has its own structure and scope, they are all complimentary and together support the overall DSE research program objective. Each is described in detail in the following sections.

## **PART II – THE OPERATIONS RESEARCH CENTER OF EXCELLENCE**

The purpose of the Operations Research Center of Excellence (ORCEN) is to provide a small, full-time analytical capability to both the Academy and the United States Army and the Department of Defense. The ORCEN was established in 1990 through a Memorandum of Agreement between the Department of Systems Engineering, the Department of Mathematics (DMath) and the Office of the Assistant Secretary of the Army (Financial Management and Comptroller). Its establishment was born of the burgeoning need for developing research opportunities to enrich DSE and DMath education.

Personnel authorizations in the ORCEN are established by a Table of Distribution and Allowances (TDA). Funding support for the Operations Research Center is established by a Memorandum of Agreement with the Office of the Assistant Secretary of the Army (Financial Management). The Operations Research Center is organized under the Office of the Dean as an Academy Center of Excellence. A permanent military Academy Professor provides oversight and supervision to the Center. In addition, the TDA authorizes one O5 analyst, three O4 analysts, and a GS5 secretary. By agreement between DSE and DMath, DSE provides three analysts, an Academy Professor as the Director and one permanent staff member to serve as Executive Administrator and assistant to the Director and DMath provides one analyst.

The Operations Research Center is sponsored by the Assistant Secretary of the Army (Financial Management & Comptroller). Fully staffed and funded since Academic Year 1990-1991, the Operations Research Center has made significant contributions to cadet education, faculty development, and the Army at large.

The following is a list of key personnel from the Operations Research Center responsible for executing the Research Plan for the Academic Year 2004. A detailed description of each research project is given in Part VIII - PRINCIPAL RESEARCH ACTIVITIES FOR AY05.

TITLE & ORGANIZATION	NAME	PHONE (DSN)	EMAIL
Professor and Head, Department of Systems Engineering	COL Michael L. McGinnis, Ph.D.	688-2701	Mike.McGinnis@usma.edu
Professor and Head Department of Mathematical Sciences	COL Gary Krahn, Ph.D.	688-5285	Gary.Krahn@usma.edu
Director, ORCEN & Associate Professor	LTC Michael J. Kwinn, Jr., Ph.D.	688-5529	Michael.Kwinn@usma.edu
Executive Officer & Research Coordinator	Ms. Linda Ann J. Albronda	688-5897	Linda.Albronda@usma.edu
Deputy Director, ORCEN & Assistant Professor	LTC Jeffrey B. Schamburg, Ph.D.	688-5539	Jeffrey.Schamburg@usma.edu
D/SE Analyst & Instructor	CPT Grant Martin, M.S.	688-5661	Phillip.Martin@usma.edu
D/MS Analyst & Assistant Professor	CPT Wiley P. Rittenhouse, M.S.	688-5168	Wiley.Rittenhouse@usma.edu
D/SE Analyst & Instructor	CPT Steven J. Henderson, M.S.	688-3573	Steven.Henderson@usma.edu

Table 1: Key ORCEN Personnel

### PART III – FACULTY RESEARCH

The Department of Systems Engineering encourages its faculty to conduct research of value for the Army and the Department of Defense during their tenure at the United States Military Academy. This specifically includes the rotating junior faculty to support their professional development.

The Department of Systems Engineering has 15 faculty members holding a Ph.D and 21 individuals on the faculty holding a Masters Degree. Additionally, there are two faculty adjunct faculty members for the Department who support research and are assigned to other organizations. Each holds their advanced degrees in disciplines which support research in systems engineering, engineering management and/or operations research. This is a tremendous research potential for significant clients within the Army and DoD.

All research in the Department of Systems Engineering is overseen by a Senior Investigator (SI) to ensure quality and completeness for the client. These Senior Investigators all hold a Ph.D in a qualified discipline for the research project presented. Most research projects have an associated junior analyst assigned to them. This contributes to the development of the junior analyst as a researcher, the Senior Investigator as a research lead and provides the client with the best research available by the Department.

The individuals in the Department who can serve as the Senior Investigator on a research project are listed in Table 2 below. The junior analysts in the Department who can serve as the analyst on a given research project are listed in Table 3 below. Included in each table are the education background and contact information for the faculty members.

NAME	EDUCATION & DEGREE	PHONE (DSN)	EMAIL
COL Michael L. McGinnis	PhD – University of Arizona – 1995 MS – Rensselaer Polytechnic Institute – 1986 BS – USMA – 1977	688-2701	Mike.McGinnis@usma.edu
COL William K. Klimack	PhD – Air Force Institute of Technology – 2002 MS – Johns Hopkins University – 1999 MMAS – US Army CGSC – 1991 BS – Lehigh University - 1979	688-4625	William.Klimack@usma.edu
Gregory Parnell	PhD – Stanford University – 1985 MS – University of Southern California – 1980 ME – University of Florida – 1974 BS – State University of NY (Buffalo) - 1970	688-4374	Gregory.Parnell@usma.edu
Patrick J. Driscoll	PhD – Virginia Tech – 1995 MS – Stanford University – 1989 BS – USMA – 1979	688-6587	Patrick.Driscoll@iusma.edu
Bobbie Foote	PhD – University of Oklahoma – 1967 MS – University of Oklahoma – 1963 BS – University of Oklahoma - 1961	688-4893	Bobbie.Foote@usma.edu
LTC Willie J. McFadden, III	PhD – Old Dominion University – 2000 MS – Naval Postgraduate School – 1993 BS – USMA – 1983	688-5941	Willie.McFadden@usma.edu
LTC Timothy E. Trainor	PhD – North Carolina State University – 2001 MBA – Duke University – 1992 BS – USMA – 1983	688-4625	Timothy.Trainor@usma.edu
LTC William Bland	PhD – University of Virginia – 2003 MS – Florida Institute of Technology – 1995 BS – USMA – 1983	688-5181	William.Bland@usma.edu
LTC Michael J. Kwinn, Jr.	PhD – University of Texas (Austin) – 2000 MS – University of Arizona – 1994 BS – USMA – 1984	688-5529	Michael.Kwinn@usma.edu
Roger C. Burk	PhD – University of North Carolina – 1993 MS – Air Force Institute of Technology – 1985 BA – St. John’s College – 1974	688-4754	Roger.Burk@usma.edu
Paul West	PhD – Stevens Institute of Technology – 2003 MTM – Stevens Institute of Technology – 2000 MBA – Long Island University – 1993 BS – State University of NY (Albany) – 1983	688-5871	Paul.West@usma.edu
LTC Robert Powell	PhD – Stevens Institute of Technology – 2002 MMAS – US Army CGSC – 1999 MS – George Mason University – 1995 BS – Texas A&M University - 1984	688-4311	Robert.Powell@usma.edu
LTC Jeffrey B. Schamburg	PhD – University of Virginia – 2004 MS – University of Virginia – 1995 BS – USMA - 1986	688-5539	Jeffrey.Schamburg@usma.edu
LTC Simon Goerger	PhD – Naval Postgraduate School – 2004 MS – Naval Postgraduate School – 1998 BS – USMA – 1988	688-5535	Simon.Goerger@usma.edu
Niki C. Goerger	PhD – Texas A&M University – 1992 MS – Mississippi State University – 1988 BS – Mississippi State University – 1986	688-3180	Niki.Goerger@usma.edu

Table 2: DSE Senior Investigator

NAME	EDUCATION & DEGREE	PHONE (DSN)	EMAIL
LTC Pamela Hoyt	PhD (ABD) – George Mason University – 2002 MS – George Mason University – 1996 MA – Naval War College – 1990 BA – University of Vermont (Burlington) – 1984	668-2788	Pamela.Hoyt@usma.edu
LTC Kent Miller	PhD (ABD) – University of Virginia – 2004 MS – Georgia Tech – 1994 BS – USMA – 1984	668-5578	Kent.Miller@usma.edu
LTC Brigitte Kwinn	MS – University of Arizona – 1994 BS – USMA – 1984	668-6493	Brigitte.Kwinn@usma.edu
LTC Veronica Zsido	MS – University of Louisville 1997 BS – USMA – 1987	668-5206	Veronica.Zsido@usma.edu
MAJ John Cushing	MS – University of Virginia – 2003 BS – USMA – 1993	668-4399	John.Cushing@usma.edu
MAJ Patrick Downes	MS – University of Virginia – 2002 BS – USMA – 1993	668-3114	Patrick.Downes@usma.edu
MAJ John Harris	MS – University of Virginia – 2002 BS – USMA – 1993	668-5536	John.Harris@usma.edu
MAJ Steven Henderson	MS – University of Arizona – 203 BS – USMA – 1994	668-3573	Steven.Henderson@usma.edu
MAJ Heidi Hoyle	MS – University of Virginia – 2004 BS – USMA – 1994	668-2073	Heidi.Hoyle@usma.edu
MAJ Robert Keeter	MS – University of Virginia – 2003 BS – USMA - 1993	668-4857	Robb.Keeter@usma.edu
MAJ Robert Lenz	MS – Ohio State University – 2003 BS – USMA – 1993	668-4756	Robert.Lenze@usma.edu
MAJ Grant Martin	MS – Georgia Institute of Technology – 2003 BS – USMA – 1994	668-5661	Grant.Martin@usma.edu
MAJ Thomas Rippert	MS – University of Texas (Austin) – 2003 BS – USMA – 1993	668-2510	Thomas.Rippert@usma.edu
MAJ Curtis Tait	MS – University of Virginia – 2004 BS – USMA – 1994	668-5537	Curtis.Tait@usma.edu
MAJ Travis Thompson	MS – Columbia University – 2004 BS – USMA – 1994	668-4792	Travis.Thompson@usma.edu
CPT Gregory Boylan	MS – Georgia Institute of Technology – 2003 BS – USMA – 1994	668-4753	Gregory.Boylan@usma.edu
CPT Travis (TJ) Lindberg	MS – University of Arizona – 2004 BS – USMA – 1995	668-4752	Travis.Lindberg@usma.edu
CPT Wiley Rittenhouse	MS – Tulane – 2003 BS – Kansas State University - 1994	668-5168	Wiley.Rittenhouse@usma.edu
CPT Eric Tollefson	MS – Georgia Institute of Technology – 2002 BS – USMA – 1994	668-5663	Eric.Tollefson@usma.edu
CPT Jason Wolter	MEM – Northwestern University – 2004 BS – USMA – 1994	668-4888	Jason.Wolter@usma.edu
CPT Ernie Wong	MS – Stanford University – 2004 MA – Stanford University – 2004 BS – USMA – 1994	668-2668	Ernest.Wong@usma.edu

Table 3: DSE Analysts

## **PART IV – CAPSTONE RESEARCH**

The third and very significant aspect of the research program within the Department of Systems Engineering is Capstone Research. This is a year-long research project conducted by a group of 3-5 Systems Engineering and Engineering Management majors within the Department of Systems of Engineering. These projects are coordinated and lead by a Senior Investigator (holding a Ph.D). These Capstone research projects fulfill the requirements for two of the final courses for each of these accredited majors (accredited by the Accreditation Board for Engineering and Technology).

These research projects are developed to support course and program objectives and each has a real-world client and is an “open ended” project. That means that the solution is not predetermined by either the client or the research lead. This provides the cadets with the opportunity to apply the techniques they have learned in their previous courses to significant research projects. It also allows the cadets to present their work orally and in writing to clients and to other researchers at conferences.

For Academic Year 04-05, we have 21 research projects for 16 different clients. These research opportunities are listed in Part VIII of this research plan.

## **PART V – ACADEMIC INDIVIDUAL ADVANCED DEVELOPMENT (AIAD)**

Cadets are provided with opportunities to participate in Academic Individual Advanced Development opportunities (AIADs) during their summer training months in addition to the military training required for graduation. These opportunities can fill two requirements.

1. Provide a means to conduct background research and initial problem definition for potential capstone research projects (these types of AIADs are provided for course credit), and/or
2. Expose cadets to applications of their academic program in a military or industry environment.

Each of these requirements supports the Department of Systems Engineering’s educational objectives. Cadets apply the lessons they learned in previous courses to projects coordinated by clients throughout the United States and many foreign countries. This broadens the cadets’ educational experience and provides a significant benefit for the clients involved.

These AIADs are normally three-weeks in length and are funded through the client or in support of other research conducted in other aspects of the Department of Systems Engineering. Though this is a relatively short stint in an organization, cadets often complete significant research projects in this time as they usually require little train-up as they are exposed to many military and academic applications prior to their arrival in a client organization and they are a very eager research source.

The list of AIAD opportunities we provided to cadets in the previous summer is listed in Part VIII of this research plan. We are always seeking new opportunities for cadets to apply their learning to client organizations.

## PART VI – THE DEPARTMENT RESEARCH FOCUS

All research in the Department of Systems Engineering, including ORCEN research, supports one or more of six main research thrusts, which are described below. By requiring each research project to support one or more research thrusts, we ensure that our research in DSE and the ORCEN is relevant to Army clients. We also maintain our focus on properly developing junior faculty and cadets through projects impacting their profession. The six research thrusts, in no particular order, are:

**Manning the Force:** This research thrust includes analysis related to the accession, development and retention of enlisted soldiers and officers in the Army. Previous clients have included Army G1, US Army Accessions Command, and Human Resources Command.

**Equipping the Force:** This research thrust includes analysis related to the requirement development, function requirement definition and acquisition of equipment to support Army and DoD operations. Primary clients for this thrust in particular are logically from the acquisition community. Previous clients have included PEO Soldier, PM-Future Combat Systems, Army Material Command, PM-Bradley and Army Research Laboratory.

**Organizing the Force:** This research thrust includes analysis related to the organizational structure of units and operations. Previous clients have included the Army Staff, Training and Doctrine Command, Army G3, Assistant Secretary of the Army (Installations and Environment), PEO Soldier, PM-Future Combat Systems.

**Training the Force:** This research thrust includes analysis related to training development and training support systems across the Army and DoD. Previous clients have included Army G3, Training and Doctrine Command, Army G8, numerous Army Divisions, including the 4<sup>th</sup> Infantry Division, and the Defense Advanced Research Projects Agency (DARPA).

**Fighting the Force:** This research thrust includes analysis related to doctrine and tactics for the Army and other DoD agencies. Previous clients have included Army G3, PEO –STRI, Defense/Army Modeling and Simulation Office (DMSO/AMSO), PM-Future Combat Systems and Training and Doctrine Command (TRADOC).

**Sustaining the Force:** This research thrust includes analysis related to the all aspects of support for the Army and DoD units while in combat, training or home-station. Previous clients have included Army G4, Surface Deployment and Distribution Command (SDDC), US Army Accessions Command, and Human Resources Command.

## PART VII – THE DEPARTMENT RESEARCH CYCLE

Regardless of the research thrust, the research source or the client, each research proposal must be approved through the DSE Research Council and the Department Head. The ORCEN Director, in the role of the Department Research Coordinator, collects potential project proposals from Senior Investigators and brings the research opportunity to the Department Research Council which is headed by the DSE Department Head. This

development of research opportunities is normally conducted in the summer, when the academic load wanes for our senior investigators.

At the beginning of the academic year in August, the ORCEN the research council convenes to review each research proposal for support and for the identification of required resources. The ultimate authority for approving the allocation of resources (which includes funding, lab time and analyst time) is the Head, Department of Systems Engineering. Once approved, the researchers can execute the research plan.

The Research Cycle for an Academic Year for the Department of Systems Engineering is illustrated in Figure 3 on the following page. This is a depiction of the objective annual research cycle, which involves several processes in executing the Research Plan. Among them is the development of research opportunities, the approval timelines and the completion times for each project. Research opportunities can be developed during the academic year, or off-cycle. These projects are tentatively approved through the Department Research Coordinator and the Department Head. They will ultimately be required to be approved by the Research Council in their January, mid-year meeting.

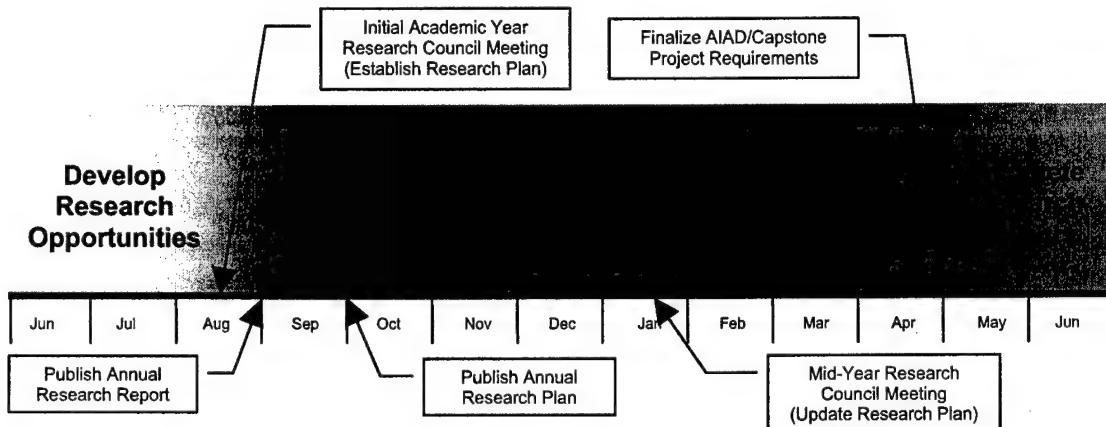


Figure 3: DSE/ORCEN Annual Research Cycle

As can be subsumed based on the cycle above and the research approval process described above, the Department and the Operations Research Center does not solicit nor conduct many “short turnaround” research projects though there are some that they conduct. The reason for this goes back to the initial objectives of the Department’s research program, which is to support the development of the junior analysts. In the ORCEN, the analysts rotate each year. To ensure that their time is used and they develop as a researcher, most projects are year-long works.

Because we seek significant, year long projects for our analysts and our Capstone cadets, the Department of Systems Engineering and the ORCEN both seek long-term client relationships. This helps ensure a steady flow of significant, open ended projects which will challenge our officers and cadets and will thereby achieve our research objectives. In the following section, we present our research activities for this current academic year.

## PART VIII – RESEARCH ACTIVITIES FOR AY05

The following pages list each planned ORCEN and DSE faculty research projects to be undertaken within the Department of Systems Engineering for Academic Year 2004-2005.

PROJECT TITLE:	CLIENT ORGANIZATION	PAGE
Simulation Roadmap for Program Executive Office (PEO) Soldier Programs	PEO Soldier	16
Operational Review for US Army Medical Materiel Center-Europe (USAMMCE) Organization	USAMMCE	20
Army M&S Terrain Database Catalogue (Baseline) and Future Framework	DAMO-SB	22
Shaping the ROTC Cohort	USA Accessions Command	26
Organizational Analysis for the Installation Management Agency (IMA)	ASA (I&E)	28
Hypersonic Projectile Mission Analysis	RDE	30
Aviation Readiness (Army Lead-the-Fleet)	PM LTF	33
Support Leader's Digital Assistant (SLDA): A Tool for the Support Platoon Leader	PM-LIS (TLDD)	37
Base Realignment and Closure (BRAC) 2005: Army Installation Military Portfolio Analysis	DASA(IA)	40
High Energy Laser Weapons: Modeling & Simulations	HEL JTO	42
Selecting Portfolios of R&D Projects	USMA – DSE	44
Information Quality & Service Reliability	OSD OFT	46
Logical Ontology to Assess Information Advantage	OSD OFT	49
Using Agent Based Models (ABMs) to determine Soldier Tactical Mission Systems (STMS) Effectiveness	ARL (SEDD)	52
Applying Value-Focused Thinking to Effects Based Operations	USMA – DSE	54

Capabilities Based Readiness Metric	USMA – DSE	56
Computing Probability of Mission Planning and Execution Success	USMA – DSE	58
Blackboard Usage Analysis and Grades Correlation	USMA – DSE	60
Interleaving Discretization & Learning to Improve Identification and Accuracy of Interference Estimates in Learning Networks	USMA – DSE	63
Development of a Data Collection Strategy in Support of PEO Soldier Simulations	PEO Soldier	65
National Academies Study on Complex Future of Models and Simulations (M&S)	DMSO	68
Acquisition Modeling and Simulation Working Group (AMSWG)	OSD (AL&T)	71
Force Scheduling Decision Support Requirements	FORSCOM G3	73
Validation Methodology for Human Behavior Representation Models	USMA – DSE	75
Distributed Sensor Network (DSN) Simulation Model	ARL SEDD	77
Tactical Ground Information Domain (T-GRID) Analytical Support	ARL CISD	80
Command and Control (C2) Metrics for Small Unit Operations in Urban Environments	ARL STO	84
Base Camp Analysis: Location, Layout and In-Theatre Infrastructure Assessment FY05	CERL	87
Deployment Analysis and Decision Support FY05	MTMCTEA	90
Homeland Defense Crisis Response Research & Readiness Center	ARDEC	92
Adaptive Virtual Analytical Test and Research (AVATAR) Environment	DARPA	96

Any questions regarding these problem statements should be directed to the D/SE Senior Investigator, the Principal Analyst, or the Client POC listed for the respective research project.

## **PART IX - AY 05 Faculty Research Program**

# **Simulation Roadmap for Program Executive Office (PEO) Soldier Programs**

**Research Proposal No.: DSE-R-0501**

**Client Organization: PEO Soldier**

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Charlie Tamez	PEO Soldier 5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	703-704-4073	Charlie.Tamez@peosoldier.army.mil

## **Problem Description:**

**Background:** PEO Soldier requires a tactical combat simulation capability for Light Infantry missions at the level of platoon and below with resolution down to the individual Soldier. The simulation capability must accept, as input, scenarios and Soldier tactical mission system (STMS) characteristics. It must model the functions of the Soldier in a tactical environment, and provide, as output, the measures of effectiveness (MOEs) used to evaluate STMS. The simulation(s) will provide the analytical capability to support PEO Soldier decision making.

Given this effective need, we developed the set of specific characteristics required of such a simulation. After a thorough study of alternatives, we recommended that PEO Soldier pursue the modification of and linkage between Combat<sup>XXI</sup>, IWARS, and OOS as the alternative that would best meet PEO Soldier needs. PEO Soldier supports our recommendation and has asked the Operations Research Center of Excellence (ORCEN) to begin with the implementation.

**Discussion:** The first step of implementation is to get “buy-in” from senior leader stakeholders in the Army and Joint communities. Consensus across the military analysis, materiel development, and combat development communities will facilitate PEO Soldier’s access to resources and their ability to influence the implementation. In addition to building consensus, briefings to the senior leadership give them an opportunity to provide feedback and recommendations.

The initial planning for implementation will occur in conjunction with the briefing process. This consists of establishing dialogue with the relevant simulation proponents, estimating costs, building a tentative timeline and set of objectives, refining the requirements, and solidifying the overall implementation plan.

Based on the results of that process, we will supervise the drafting and acceptance of Memoranda of Agreement (MoA) and/or Memoranda of Understanding (MoU) between PEO Soldier and the appropriate simulation proponents. Those documents enumerate explicit and detailed requirements that will be met by each party, to include tasks, costs, timelines, and reporting requirements. Once the MoA/MoUs are in effect, we must

supervise execution of the plan by tracking reports, solving any issues that may arise and updating agreements as necessary. This will also include facilitating and possibly conducting an independent assessment of the simulation progress. The supervision of the execution of the plan is a continuous process that requires a systems engineering approach to ensure that the recommended system of systems achieves its potential.

**Conclusions:** The Infantry soldier deserves the best equipment available in the shortest amount of time. Effective modeling and simulation (M&S) support throughout the materiel lifecycle will facilitate that timely and cost-effective fielding. The key to this M&S support is the development of an effective tool, or set of tools, available to the decision maker. By implementing the modification of and linkage between Combat<sup>XXI</sup>, IWARS, and OOS to meet PEO Soldier's needs, the Army will acquire a powerful tool to support PEO Soldier decision making.

### **Proposed Work:**

Tasks to be performed and issues to address:

1. Gain Senior Joint and Army stakeholder "buy-in"
  - a. Prepare and conduct executive-level briefings for senior Army and Joint leadership.
  - b. Refine briefings based upon stakeholder feedback.
2. Implementation – Planning for Action
  - a. Establish dialogue with PEO Soldier organizations and simulation proponents.
  - b. Estimate implementation lifecycle costs.
  - c. Build a tentative execution timeline.
  - d. Refine simulation requirements.
3. Implement the plan – Execution
  - a. Coordinate, mediate, and draft Memoranda of Agreement (MoA) and/or Memoranda of Understanding (MoU) between PEO Soldier and simulation proponent agencies which include:
    1. Key tasks and identification of responsible party;
    2. Intermediate and long-term objectives;
    3. Execution timeline;
    4. Critical path.
  - b. Finalize initial funding requirements.
  - c. Estimate implementation lifecycle costs.
  - d. Refine simulation requirements.
  - e. Assist with development of product simulation support plans (SSPs).
4. Implementation – Supervision

- a. Monitor all reports, both formal and informal.
- b. Solve issues as they arise.
- c. Update memoranda as necessary.
- d. Coordinate for and execute the independent assessment of simulation development and capability by:
  - 1. Identifying an appropriate independent software assessment vehicle or organization.
  - 2. Obtaining the latest versions of Combat<sup>XXI</sup>, IWARS, and OOS.
  - 3. Receiving training on the above software.
  - 4. Testing the software against the requirements.
- e. Assist with simulation support plans (SSPs).

Provide monthly interim progress reports (IPRs) to the Deputy, PEO Soldier (DPEO Soldier).

#### **Requirements and Milestones:**

MILESTONE	DATE
Stakeholder briefings	1 Sep 04
All required MoA / MoU signed	1 Oct 04
Program review	15 Nov 04
Identify Independent Assessment Method	1 Dec 04
Program review	15 Feb 05
Test of Initial Capabilities Complete	15 May 05
Program review	15 Aug 05
Program review	30 Sep 05

#### **Project Deliverables and Due Date:**

- Executive-level briefing to Senior Army Leadership and Joint Agencies (NLT 1 Sep 04)
- Memoranda of Agreement / Memoranda of Understanding signed (NLT 1 Oct 04)
- In-Progress Reviews (Monthly)
- Technical report. (30 Sep 05)

**Senior Investigators:** LTC Michael J. Kwinn, Jr., Ph.D., Associate Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529, Dr. Paul D. West, Ph.D., Assistant Professor, USMA - Department of Systems Engineering, 845-938-5871.

**Faculty Analysts:** CPT Grant Martin, M.S., Instructor & Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5661; CPT Eric S. Tollefson, M.S., Assistant Professor, USMA - Department of Systems Engineering, 845-938-5663; CPT Gregory Boylan, M.S., Instructor, USMA - Department of Systems Engineering, 845-938-4753.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 60 Hours

**Principal Analyst:** 750 Hours

**Lab Use Hours:** Combat Simulation Lab, 80 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Operational Review for US Army Medical Materiel Center-Europe (USAMMCE) Reorganization**

**Research Proposal No.: DSE-R-0503**

**Client Organization:** United States Army Medical Materiel Center, Europe (USAMMCE)

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
MAJ David Gibson	U.S. Army Medical Materiel Center, Pirmasens, Germany	DSN 314-495-6046	david.r.gibson@us.army.mil
MAJ Jeff Roberts	U.S. Army Medical Materiel Center, Pirmasens, Germany	DSN 314-495-7174	jeffrey.a.roberts@us.army.mil

## **Problem Description:**

The United States Army Medical Materiel Center, Europe faces a critical manpower shortage given their current structure and reliance on borrowed military manpower following the realignment and relocation of troops in Germany following the end of the Cold War. This problem has surfaced as especially critical given the increase in operational requirements from the current action and deployments in the CENTCOM and EUCOM AORs. USAMMCE is seeking to reorganize their organization to better be able to effectively and efficiently respond to any additional future requirements without having to compromise on effectiveness or efficiency in meeting current requirements.

## **Proposed Work:**

Our team will review the current staffing, organizational structure, functions and business processes associated with the USAMMCE and other similar organizations in order to provide alternative options based on operational requirements to the USAMMCE Command Group to allow them to make an informed decision, looking at impact and cost effectiveness.

## **Requirements and Milestones:** TBD

## **Project Deliverables and Due Date:**

- Interim IPRs: Expected dates, 1998/9.
- Final Briefing: Due date, 1999.
- Technical Report: Due date, 1999.

**Senior Investigator:** LTC Michael J. Kwinn, Jr., Ph. D., Associate Professor & Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

**Faculty Analyst(s):** 2LT Heather I. Ritchey, B.S., Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-8169.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 200 Hours

**Principal Analyst:** 200 Hours

**DoD Research Thrust:**

**X ORGANIZING – the Force**

- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- X SUPPORTING – the Force**

# Army M&S Terrain Database Catalogue (Baseline) and Future Framework

Research Proposal No.: DSE-R-0504

**Client Organization:** BCSE

## Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Ed Curle	Battle Command, Simulation & Experimentation Office (DAMO-SB) Fort Belvoir, Virginia	703-601-0014	Edwin.Curle@hqda.army.mil

## Problem Description:

The Army's Transformation to Future Force and the enabling of the Future Combat System (FCS) require the ability to support battle command and embedded training with models and simulations (M&S). In so doing, we must also transform the capability to obtain, manage, and distribute geospatial data for any geographic area of interest. As stated in the Army Geospatial Data Integrated Master Plan (AGDIMP), “[t]he vision for Army Geospatial data operations is an Integrated, Network-Centric, End-to-End Process – with an architecture and distributed network for geospatial terrain data that are compatible to support the Future Combat System (FCS), Future Battle Management Command and Control Operations, and the Army's Future Force.” (Army Geospatial Data Master Plan, Final Draft, June 2004) The AGDIMP identifies problems with the current system to include the need for “better geospatial storage and distribution systems that can be integrated with the Network Centric operations of the Future Force.” Before developing the future system, it is critical to assess the current state of terrain databases and investigate the issues with and implications for managing that terrain data. While it is important to establish a baseline catalogue of the current inventory of terrain databases, it is first important to develop a methodology for managing that data.

Terrain databases are often tailored for particular studies, analyses, training exercises, and missions. As a result, there can be several, or several dozen, different terrain databases for the same geographic location. Each of those database instances has its own modifications and implicit assumptions embedded in the data. This situation is further confounded because each terrain database is built to work on specific software platforms and is not necessarily compatible with other systems due to terrain database format issues. For users to assess the availability and goodness of existing terrain databases for their intended use, it is imperative that sufficient information describing the content and quality be available for review.

**Objective:** The objectives of this study are to (a) design terrain database catalogue / metadatabase in terms of information needed to describe the database content, which supports user assessment, (b) to develop a baseline catalogue of terrain databases, and (c) to provide a framework for future development. The scope of the work will include terrain databases based on a select group of platforms as identified with the client. Modeling and

simulation systems will include but are not necessarily limited to OneSAF Testbed Baseline, OneSAF Objective System, WARSIM, and Joint Semi-Automated Forces.

**Approach:** In this study, we propose to employ the Systems Engineering Management Process (SEMP) to identify the critical data which describes and categorizes a particular terrain database. Doing so will provide the basis for a framework to manage and utilize these terrain databases, regardless of the geographic area or software platform on which it is based. The Systems Engineering and Management Process (SEMP) is a robust, deliberate problem solving methodology taught in the Department of Systems Engineering at the United States Military Academy. It has been used widely in a variety of applications, both on military and commercial problems. The SEMP has recently been employed in development of an operational assessment system for Operation Enduring Freedom, in support of the Base Realignment and Closure (BRAC) study group, and to analyze the regional structure of the Army Installation Management Agency.

The first step in this process is assessing our current inventory and management of terrain databases. This will begin to produce a baseline catalogue of those databases. We will leverage our efforts in this area with others currently ongoing in the field. A concurrent step will be to collect information from key stakeholders in the modeling and simulation field. We will do this in a group setting. These two efforts, taken together will result in a better definition and more accurate scope of the problem. Capturing those insights will also be critical in linking this project to the initiatives spelled out by the AGDIMP, as well as anticipating future requirements.

After collecting the information in the compiled catalogue and obtained through group sessions, we will be able to establish the relative importance of including or not including specific elements of data (metadata) about a terrain database. Based on that knowledge, we will be able to generate different alternatives for managing these databases. Each of those alternatives can also be considered with respect to its contribution or connection to the AGDIMP, as well as to future systems. Finally, we will make a recommendation as to the final framework of and specific data to include in this management structure.

The Army is transforming to anticipate future threats. Part of that transformation involves implementing a battle command system that is network-centric and compatible/interoperable with modeling and simulation. In order to efficiently achieve that, it is necessary to create a framework for managing and organizing our terrain databases. This study will provide not only a baseline catalogue of those databases, but also that organizational structure which will allow its management.

### **Proposed Work:**

Tasks to be performed and issues to address:

- Define Problem - Terrain Database Catalogue / Metadatabase Design
  - Scope problem with client in terms of systems to consider in the study
  - Develop focus and brainstorming questions for needs analysis sessions

- Identify stakeholders and conduct needs analysis to capture content for catalogue/metadata and to use in data call for cataloging existing terrain databases
  - Identify existing and developing terrain catalogues
- Conduct Design and Analysis of Alternatives with Stakeholders
  - Host stakeholder analysis and functional decomposition session(s) with focus and brainstorming questions
  - Identify elements of terrain databases that sufficiently describe the content or that make them unique
  - Develop several alternatives for data to include in a management and assessment framework
  - Frame alternatives, based on stakeholder priorities, for presentation to those stakeholders and AMSO
- Recommend and Select Alternatives
  - Prioritize alternatives/elements, based on stakeholder input and a consideration of future requirements
  - Develop recommendations and present to clients and stakeholders
- Implement Terrain Database Catalogue Framework
  - Conduct data call to compile current inventory of terrain databases (Grant, I don't think you can do this until you know the fields you want filled out)
  - Develop Terrain Database Catalogue Structure
  - Populate Terrain Database Catalogue with results of the data call

**Requirements and Milestones:**

MILESTONE	DATE
Scope problem with client (systems on which to focus)	15 September
Develop focus and brainstorming questions for needs analysis	20 September
Identify stakeholders	20 September
Identify existing and developing terrain catalogues	20 September
Conduct needs analysis with stakeholders (group sessions)	30 October
Identify elements of terrain databases that sufficiently describe the content or that make them unique	30 October

Develop several alternatives for data to include in a management and assessment framework	15 November
Conduct IPR to BCSE / selected stakeholders to review current inventory and research to date	15 November
Develop prioritized list of essential metadata for this framework	1 December
Develop a recommendation for the framework for managing terrain databases	10 December
Conduct data call to populate this framework	10 December

**Project Deliverables and Due Date:**

- Baseline inventory of current terrain databases and recommended framework for managing those databases 10 December
- Technical Report 20 February

**Senior Investigators:** LTC Jeffrey B. Schamburg, Ph.D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

**Faculty Analysts:** MAJ Grant Martin, M.S., Instructor and Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5661.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 60 hours

**Principal Analyst:** 250 hours

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

**X EQUIPPING – the Force**

**FIGHTING – the Force**

**SUPPORTING – the Force**

## **Shaping the ROTC Cohort**

**Research Proposal No.: DSE-R-0505**

**Client Organization:** U.S. Army Accessions Command, Fort Knox, KY

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER/E-MAIL:
LTC Steve McCarty	Headquarters, U.S. Army Accessions Command ATTN: ATAL-AR 1307 3 <sup>rd</sup> Avenue Fort Knox, KY 40121-2726	502-626-0322	Stephen.Mccarty@usaac.army.mil
MAJ Bill Warner	ATTN: ATTC-OP 55 Patch Road Fort Monroe, VA 23651	757-788-4606	William.Warner@usacc.army.mil
CPT Vaughn Delong	ATTN: ATTC-OP 55 Patch Road Fort Monroe, VA 23651	757-788-3430	Vaughn.Delong@usacc.army.mil

### **Problem Description:**

Army ROTC achieved its overall commission mission of 3,900 officers in fiscal year 2003 for the first time in a number of years and is postured to repeat this success in upcoming years. *College ROTC: The Way Ahead*, dated 4 April 2001, was instrumental in providing focus and direction to the command by articulating what needed to be improved and how to make the changes necessary to achieve success.

To meet the future needs of the Army a new model has been developed – Shaping the Cohort (STC) – which is designed to shape each cohort to meet the Army's specific needs in terms of component, academic disciplines, race/ethnic makeup goals, gender, and targeted missions. STC does this by determining and examining the “prime market” at a university and basing the detachment’s mission on penetration of that market as opposed to one based on past performance. It is believed that the STC model improves the method of determining missions.

To determine market potential, two surveys were taken that included 62 colleges and universities and over 7600 students. The goals of the survey were to determine knowledge and perception of Army ROTC among students, segmentation of local markets, how the school markets differed, and the characteristics that could lead to participation in Army ROTC. The data gathered is used to determine how many students at each school fit the criteria for the prime market.

### **Proposed Work:**

The purpose of this work is to provide an independent assessment of the model's adequacy and to determine if and how it can be improved. This work includes a needs analysis, an analysis of the STC model and the process for determining missions, and the development of alternatives for improving the STC model. The final product will include an assessment

of the model and a recommendation(s) for improvements. These recommendations will be provided to USACC.

### **Requirements and Milestones:**

EVENT	TIMEFRAME
Initial Coordination	14 September 2004
IPR	Mid-October 2004
IPR	Mid-November 2004
Final Briefing	Mid-December 2004

### **Project Deliverables and Due Date:**

- Final Briefing: December 2004.
- Technical Report: December 2004.

**Senior Investigator:** LTC Jeffrey B. Schamburg, Ph. D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5539.

**Faculty Analyst(s):** CPT Wiley P. Rittenhouse, M.S., Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5168.

### **Resources Required for Project:**

#### **Research Hours Required (by position):**

**Senior Investigator:** 20 Hours

**Principal Analyst:** 100 Hours

### **DoD Research Thrust:**

- X ORGANIZING – the Force**
- X MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Organizational Analysis for the Installation Management Agency (IMA)**

**Research Proposal No.: DSE-R-0506**

**Client Organization:** Assistant Secretary of the Army for Installations and Environment  
(ASA(I&E))

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Geoff Prosch ASA(I&E)	ASA(I&E), HQDA Pentagon, Washington DC	703-692-9801	geoffrey.prosch@us.army.mil
MG Lust	Assistant Chief of Staff for Installation Management (ACSIM) HQDA, Pentagon Washington, DC		Larry.Lust@hqda.army.mil
MG Johnson	Director, Installation Management Agency		Ronald.Johnson1@us.army.mil
Mr. Scott Dias	Plans, IMA	703 602-6854	Scott.Dias@hqda.army.mil

## **Problem Description:**

Mr. Geoff Prosch, Acting ASA(I&E), asked USMA at the end of May 2004 to conduct an independent assessment of IMA's use of four regions to monitor, supervise and execute installation management in CONUS. Mr. Prosch wants this assessment of the IMA region structure to use in reporting to the Installation Management Board of Directors (IMBOD) at their next meeting in OCT 04. The scope of this study is limited to the IMA management organization in CONUS above the garrison level. The study mission statement:

- a. Task: Conduct an organizational analysis of the IMA CONUS region structure for the ASA(I&E) and the ACSIM NLT 13 AUG 04.
- b. Purpose: To evaluate the effectiveness and efficiency of the current structure and provide recommendations for potential alternative structures.

The Department of Systems Engineering (DSE) at USMA performed this study during June-August 2004 and provided an out-brief to the ASA(I&E). Plans for using the study results are currently under consideration by the ASA(I&E) and ACSIM.

## **Proposed Work:**

D/SE will prepare a written study report from the Jun-Aug 2004 work and brief results to further HQDA leadership as requested by the ASA(I&E). D/SE will serve in an advisory role to the IMA in adopting any of the study recommendations approved for implementation by HQDA.

**Requirements and Milestones:**

- Brief study results to the ACSIM and Director of the Installation Management Agency.
- Prepare a written study report from the Jun-Aug 2004 study.
- Brief study results to other HQDA leadership as requested by the ASA(I&E).

**Project Deliverables and Due Date:**

- Study results brief to the ACSIM and Director, IMA, on 21 Sep 2004.
- Draft Study Report to the ASA(I&E) on 21 Sep 2004.
- Possible study results brief/summary to the VCSA in Oct 2004.
- Possible study results brief/summary to the DA Installation Management Board of Directors (IMBOD) on 20 Oct 2004.

**Senior Investigator:** Dr. Gregory Parnell, Ph.D., Professor, USMA - Department of Systems Engineering, 845-38-4374.

**Faculty Analyst(s):** LTC Timothy E. Trainor, Ph.D, Assistant Professor, USMA – Department of Systems Engineering, 845-938-5534, CPT Jason A. Wolter, Instructor, USMA – Department of Systems Engineering, 845-938-4888.

*NOTE:* Several faculty members were involved in the study during the initial period Jun-Aug 2004. Only those listed above are expected to continue work on this project in FY05.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 52 Hours

**Principal Analyst:** 104 Hours

**DoD Research Thrust:**

**X ORGANIZING – the Force**

- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# Hypersonic Projectile Mission Analysis

**Research Proposal No.: DSE-R-0508**

**Client Organization:** Army Aerospace Command (RDE)

## **Point of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Helmut Haas	SAIC 6725 Odyssey Drive Huntsville, AL 35806	256 864 7048	Helmut.h.haas@saic.com
Bob Walker	BAE	256-864-2134	Bob.walker4@baesystems.com

## **Problem Description:**

The successful testing of SCRAM Jet technology, in March 2004, heralds a new era for flight in the commercial and military arena. This new technology has the potential to fly systems at speeds of up to mach 12. The question from an army perspective is, ‘how will this capability be used best to provide a means of meeting future mission requirements of the Army?’ Other questions are how do we employ and support this technology to meet Army mission requirements and what is the projected cost? How will this technology meet our problems of air defense including cruise missiles and other future difficult threats? How will and could this be used to allow the Army keep a larger distance from the enemy in lethal engagements? Assuming a deployment time frame of 2025, what process, procedures, equipment, training, etc. would the Army need to invest in to incorporate and realize the benefits of this technology?

## **Proposed Work:**

The Department of Systems Engineering proposes to undertake and perform the following investigative research:

- 1) Identify the set of feasible mission profiles that would be enhanced or met by systems with hypersonic flight capability
- 2) Develop potential scenarios that support the identified mission profiles
- 3) Define the development and employment roadmap and considerations that should be followed to fully and effectively meet the mission requirement
- 4) Define the complete system plan that must be followed by the Army: research and development; logistics support; training and doctrine issues, integration with existing capabilities; joint, combined and coalition issues; maintenance issues; and cost.

- 5) Identify the risks associated with development, fielding and employment of hypersonic flight capability.
- 6) Define ethical problems and issues that would hinder development of this capability.
- 7) Interact with study teams at Fort Bliss, Fort Sill, and Huntsville to educate our team on the continuing changes that will occur in the technology and appraise them of our findings.

**Unit Funding (\$K):**

	FY04	FY05	FY06	FY07
HW and SW procurement	\$105			
Technician support	\$	\$100	\$120	\$120
Travel	\$ 15	\$ 20	\$ 45	\$ 20
HW and SW Warranties/Upgrades	\$ 15	\$ 10	\$ 85	\$ 15
Contract Personnel Support	\$ 15	\$ 30	\$ 50	
<b>TOTAL</b>	<b>\$150</b>	<b>\$150</b>	<b>\$300</b>	<b>\$155</b>

**Milestones:**

• Identify required software and hardware technologies	Q3 FY04
• Conduct literature review to help frame the discussion and determine the gaps	Q3-4 FY04
• Procure and install selected technology for use in analysis	Q4 FY04
• Training and support requirements for acquired technology	Q4 FY04
• Plan, conduct, analyze Delphi Group discussion to identify mission profiles	Q1 FY05
• Prepare interim report to client on identified Army mission profiles	Q1 FY05
• Develop potential scenarios supporting mission profiles	Q2 FY05
• Brief client on scenarios and refine	Q2 FY05
• Develop roadmap considerations for capability development and employment	Q3 FY05
• Database development	Q2-4 FY05
• Define the complete system plan for the hypersonic flight capability	Q4 FY05
• Plan, conduct, analyze Delphi Group II discussion on hypersonic flight capability	Q1-2 FY06
• Database development	Q2-4 FY06
• Prepare Interim Technical Report and IPR	Q3 FY06

• Identify associate risks with development, fielding and employment	Q4 FY06
• Define ethical issues	Q4 FY06
• Final Technical Report and Briefing	Q1-3 FY07

#### **Deliverables:**

This is a multi-year project expected to start in FY04 and conclude in FY07. A comprehensive report detailing the work on all six research areas stated above.

**Senior Investigator:** Dr. Bobbie L. Foote, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893, LTC Willie J. McFadden II, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-5941, Dr. Roger C. Burk, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4754.

**Supporting Laboratory Technician:** John Melendez, M.S., Computer Network Specialist, Department of Systems Engineering, 845-938-5872.

#### **Resources Required for Project:**

##### **Research Hours Required**

**Senior Analysts:** 3 man years(includes Dr. Foote and Dr. Burk)

**Investigators:** 3 man years each(includes officers from the ORCEN)

**Lab Technician:** 3 man years(computer scientist added in 2<sup>nd</sup> year)

#### **DoD Research Thrust:**

##### **X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

##### **X EQUIPPING – the Force**

**FIGHTING – the Force**

**SUPPORTING – the Force**

## **Aviation Readiness (Army Lead-the-fleet)**

**Research Proposal No.: DSE-R-0509**

**Client Organizations:** PM LTF, Aviation and Missile Research, Development and Engineering Center (AMRDEC), U.S. Army Research, Development and Engineering Command (RDECOM), Redstone Arsenal, AL 35898. APM LTF, U.S. Army Aviation Technical Test Center (ATTC), Developmental Test Command (DTC), Fort Rucker, AL

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mike McFalls PM LTF Army Test and Evaluation	AMRDEC, US Army RDECOM AMSAM-RD, Bldg 8716 Redstone Arsenal, AL 35898	DSN 746-3462 256-876-3462 Cell: 256-714-8362	<a href="mailto:Michael.McFalls@rdec.redstone.army.mil">Michael.McFalls@rdec.redstone.army.mil</a>
Bill Braddy Deputy PM LTF Westar Corporation	Huntsville Engineering Center 4950 Corporate Drive, Suite 125 Huntsville, AL 35805	(256) 430-1610 x148 Cell: (256) 457-0368	<a href="mailto:braddy@cobrohsv.com">braddy@cobrohsv.com</a>

### **Problem Description:**

The purpose of the Lead the Fleet Revised (LTF-R) program is to gain better insight into the accumulated damage that each U.S. Army helicopter experiences during actual operational usage and to use that knowledge to evaluate overhaul and retirement times, increase safety and operational readiness, and reduce costs. The LTF approach is to examine aircraft usage data to identify linkages between certain flight conditions and component failure. These conditions included basic parameters such as gross weight, airspeed, altitude, roll angle, vertical acceleration, and ground-air-ground cycles.

### **Proposed Work:**

The Operations Research Center of Excellence (ORCEN) will provide a full-time analyst and additional faculty members to provide data modeling and architecture design, and statistical and analytical research. Potentially, the ORCEN will also involve cadets in this year's research effort. Cadet involvement is beneficial in that it exposes cadets to real Army challenges and enables them to make an impact on the future of the Army which they will serve. As future leaders this experience also gives them an insight into Army Aviation and enables them to see how Lead-the-Fleet will affect future aviation operations. Cadets will be offered Academic Individual Advanced Development (AIAD) opportunities to work as summer interns with LTF operations both in the field and with Westar headquarters. Analysts will conduct a thorough review of existing documentation and interviews of appropriate personnel to fully understand the current LTF mission, goals and

measures of effectiveness. LTF will provide data collection, data dissemination, clarification and comments throughout the course of this effort.

### **Requirements and Milestones:**

1. Develop a universal army aviation maintenance data warehouse (AMDAW) to support LTF-R stakeholders. This includes development of a universal and scalable data model and design of a prototype data repository. The ORCEN will outline a universal object-oriented model that accommodates the needs of major aviation maintenance data customers including Aviation Engineering Directorate (AED), PEO-AV, AMCOM, and PMs. The design process will employ a spiral approach involving two iterations.

*Iteration 1* (15 Sep 2004 – 1 Jan 2005) will result in an initial prototype focusing on VMEP, MDR, and ELAS data and serving LTF-R engineers, AED, IMCC and key PMs.

*Iteration 2* (1 Jan 2005 – 1 July 2005) will expand the prototype to IMD/HUMS, UniRAM, OSMISS, and AMSAA data sources, and serve AED, ELAS, EDRS, PM TMDE, PM Cargo, PM Attack, PM Utility and IMCC.

2. Assist LTF engineers and statisticians with experimental design and validation. Specific deliverables include:

### **Project Deliverables and Due Date:**

#### ***Iteration 1:***

- a. Task 1-1-1: NLT 1 OCT 2004, develop initial business requirements for AMDAW design. Specifically, identify initial data requirements (in the form of use cases) for AED, IMMC, PM-TMDE, PM-Attack, PM-Utility, PM-Cargo, and LTF-R engineers.
- b. Task 1-1-2: NLT 15 OCT 2004, develop initial logical model. Specifically, develop initial object model and entity relation diagram (E-R diagram) for the Army's aviation maintenance system (unit and intermediate levels) capable of encapsulating entities residing in the following major data sources: VMEP, MDR, and ELAS. Ensure logical model is scalable and can eventually accommodate pertinent entities in the following data sources: IMD/HUMS, Parts Tracking Databases, UniRAM, OSMISS, and AMSAA.
- c. Task 1-1-3: NLT 1 NOV 2004, develop XML data specification for the logical model.
- d. Task 1-1-4: NLT 1 NOV 2004, define initial and scalable prototype architecture for database physical design (software and hardware instantiation of logical design).
- e. Task 1-1-5: NLT 15 NOV 2004, identify data transformation requirements and treatments for migrating the following data source to AMDAW: VEMP, MDR, and ELAS. Produce software design documents (Work Breakdown Structure and Data Flow Diagram) to address data transformation requirements.

- f. Task 1-1-6: NLT 15 DEC 2004, develop initial software prototypes (applications) to execute the data transformation tasks described in Task 1-1-5.
- g. Task 1-1-7: NLT 1 JAN 2004, develop initial software prototypes (applications) capable of satisfying key data access use cases identified in Tasks 1-1-1.

***Iteration 2:***

- a. Task 1-2-1: NLT 1 FEB 2005, complete second generation of business requirements for the following customers: AED, ELAS, EDRS, PM-TMDE, IMMC, PM-Utility, PM-Attack, PM-Cargo, and LTF-R engineers. Publish updated use cases for each.
- b. Task 1-2-2: NLT 15 MAR 2005, publish an updated logical model (expanded object model and E-R diagram) and XML specification capable of encapsulating all entities residing in the following data sources: VMEP, IMD/HUMS, MDR, ELAS, UniRAM, OSMISS and any other pertinent data sources required to meet the demands discovered in Task 1-2-1.
- c. Tasks 1-2-3: NLT 15 APR, identify data transformation requirements and treatments for interfacing new data sources identified in Task 1-2-1. Produce software design documents (work breakdown structure and data flow diagrams) to address data transformation requirements.
- d. Tasks 1-2-4: NLT 15 APR, develop initial software prototypes to execute the data transformation tasks described in Task 1-2-3.
- e. Task 1-2-5: NLT 15 MAY, develop second-generation software prototypes capable of satisfying data access requirements identified in Task 1-2-1.

***Design of Experiments Portion:***

- a. Tasks 2-1: NLT 21 SEP, identify 3 candidate experiments and associated data requirements for CBM prototype integration. Provide experiment concept to LTF-R engineers for actual development of design of experiment (DOE).
- b. Task 2-2: NLT 1 OCT, provide data to support the candidate experiments outlined in Task 2-1.
- c. Task 2-3: As required, provide validation of DOE's produced by LTF-R engineers.

**Senior Investigator:** LTC Michael J. Kwinn, Jr., Ph. D. Associate Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

**Faculty Analyst:** CPT Steven Henderson, M.S., Instructor and Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-3573.

**External Analyst(s):** MAJ Mark Gorak, M.S. MEPCOM, Chicago, IL

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 5 Hours/wk: 210 hours

**Principal Analyst:** 40 Hours/wk: 1680 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Support Leader's Digital Assistant (SLDA): A Tool for the Support Platoon Leader**

**Research Proposal No.: DSE-R-0510**

**Client Organization(s):** Program Manager Logistics Information System (PM-LIS), Fort Lee, VA. PM-LIS Tactical Logistics Data Digitization (TLDD), Fort Monmouth, NJ.

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER/E-MAIL:
Mr. Joseph Potoczniak Dep. Asst. PM	PM-LIS Tactical Data Digitization SFAE-PS-RS-TLD Myer Center, Bldg. 2700, Room 1B410 Fort Monmouth, NJ 07703-5626	Ofc: 732-32-3698 Cell: 732-39-6077	Joseph.Potoczniak@us.army.mil
MAJ Wilbur Richburg	PM-LIS Tactical Data Digitization SFAE-PS-RS-TLD Myer Center, Bldg. 2700, Room 1B410 Fort Monmouth, NJ 07703-5626	732-427-8354 DSN 987	Wilbur.Richburg@us.army.mil
Mr. Kevin E. Dice	Bearing Point 308 Harper Drive, Suite 320 Moorestown, NJ 08057	856-642-5023	kdice@bearingpoint.net
Mr. Russell Lofquist Senior Consultant	Bearing Point 308 Harper Drive, Suite 320 Moorestown, NJ 08057	Ofc: 856-642-5056 Cell: 856-912-7410	rlofquist@bearingpoint.net
Mr. Michael Sligh Consultant	Bearing Point 308 Harper Drive, Suite 320 Moorestown, NJ 08057	Ofc: 856-642-5002 Cell: 732-829-1125	msligh@bearingpoint.net

### **Problem Description:**

Currently, there are no tools designed to assist the maneuver battalions in daily logistics forecasting outside of the Class IX arena. Maneuver battalions forecast their logistical requirements (from support platoon leader through battalion S4) primarily by hand or with tools developed "in-house". Maneuver unit personnel typically seek the assistance of FSB company commanders through informal channels to aid in accurate logistics forecasting. The goal is to achieve the most accurate supply forecast possible, but under the current system, over-forecasting or under-forecasting is common, which can result in unnecessary risk to the mission, maneuver units, or support unit personnel. Part of the problem is that maneuver unit personnel do not get the detailed logistics training needed to do accurate forecasting without outside assistance. Currently, the only automated tools available are designed for brigade level and above. Often, the inefficiencies and forecasting errors that originate below brigade level will propagate through the supply system, further stressing it.

### **Proposed Work:**

We propose to develop a tool designed for the officers and non-commissioned officers in a maneuver battalion who are serving in logistics positions (support platoon leaders, battalion S4) to assist them in accurate logistical forecasting and rapid transfer of this information to higher echelons. This tool will be developed in Microsoft Excel and converted to an application than can be used on a handheld electronic device. The goals of this system are ease of use, fast and accurate supply forecasts, and simplified data transfer. Additionally, the proposed work would include:

- Stakeholder analysis
- Design for standard and non-standard systems
- Application development
- Testing at task force level
- Limited fielding

### **Requirements and Milestones:**

EVENT	TIMEFRAME
Research trip	June/July 2004
Problem definition & stakeholder visits	August 2004
IPR (problem definition)	October 2004
Value system design	October 2004
Coordination trip	December 2004
IPR (requirements)	January 2005
Program testing	February 2005
Small-scale testing	May 2005
Final briefing	May 2005
Final report complete	May 2005
Larger-scale test fielding	July 2005

### **Deliverables:**

- Excel program
- Palm OS (.prc) or Pocket PC program
- Report on fielding recommendations

**Senior Investigators:** LTC Michael J. Kwinn, Jr., Ph.D., Associate Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

**Faculty Analysts:** CPT Wiley Rittenhouse, M.S., Instructor & Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5168, MAJ Holly West, M.S., Instructor, Executive Officer, USMA - Office of the Dean and Analyst, USMA – Department of Systems Engineering, 845-938-2000.

**Supporting Laboratory Technician:** Mr. Michael Sligh (see points of contact)

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 25 hours

**Principal Analyst:** 200 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Base Realignment and Closure (BRAC) 2005: Army Installation Military Value Portfolio Analysis**

**Research Proposal No.: DSE-R-0511**

**Client Organization:** Deputy Assistant Secretary of the Army (Infrastructure Analysis)

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Dr. Craig College, Deputy Assistant Secretary of the Army (Infrastructure Analyses)	Army TABS Office 1400 Key Blvd, Suite #2 Arlington, VA 22209-1518	703-697-3388	craig.college@us.army.mil
COL William Tarantino, Chief, Modeling Support Team	Army TABS Office 1400 Key Blvd, Suite #2 Arlington, VA 22209-1518	703-696-9529	william.tarantino@us.army.mil

## **Problem Description:**

The purpose of this research project is to provide Base Realignment and Closure (BRAC) 2005 infrastructure analysis support to Dr. Craig College, Deputy Assistant Secretary of the Army (Infrastructure Analysis) and the Total Army Basing Study (TABS) Group. There have been four previous BRAC rounds in 1988, 1991, 1993 and 1995, during which defense officials picked 97 major domestic bases for closure, 55 major bases for realignment and 235 minor installations to be either closed or realigned. The BRAC 2005 round will be part of the Defense transformation effort with strong involvement of the OSD and Joint Staff. The services will develop their BRAC methodologies in 2003-2004. The installation data call was be conducted in 2004. The BRAC Commission will be formed in 2005 to recommend realignments and closures to the SECDEF and President. We will develop and implement a methodology to assess the military value of each Army installation and the total Army infrastructure.

## **Proposed Work:**

- Continue to help develop an objective, credible, and auditable methodology for BRAC Army infrastructure installation Military Value Analysis that will support senior Army decision makers.
- Provide advice on installation portfolio analysis and help the Army Center for Concepts Analysis implement the Army Military Value Model using approved decision support software.
- Assist in writing a white paper that describes the methodology to support BRAC decision making.
- Supervise a cadet capstone research project that will analyze BRAC historical data, develop a BRAC 2005 complexity model, and identify BRAC 2005 implementation performance measures.

**Methodologies:**

The methodologies we are using are stakeholder analysis, Multiple Objective Decision Analysis, and portfolio analysis using optimization.

**Requirements and Milestones:** Periodic meetings in Washington, DC

**Project Deliverables and Due Dates:**

- Technical Report for Cadet Capstone Project, August 2005

**Senior Investigator:** Dr. Gregory S. Parnell, Ph.D., Professor, USMA - Department of Systems Engineering, 845-938-4374.

**Analysts:** LTC Willie McFadden, Ph.D., Associate Professor & Program Director, USMA - Department of Systems Engineering, 845-938-5941, LTC Michael J. Kwinn Jr., Ph.D., Associate Professor & Director, Operations Research Center of Excellence, USMA - Department of Systems Engineering, 845-938-5529, MAJ John Harris, M.S., Instructor, USMA - Department of Systems Engineering, 845-938-5536.

**Number of Cadets Involved:** One cadet design team of five cadets: two Systems Engineering majors, two Engineering Management majors, and one Information Systems Engineering Major.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator / Principal Analyst:** 520 hours (10 hrs per week)

**Analysts:** 104 hours (2 hrs per week)

**Total Cadet Time:** 1500 hours (5 cadets for 2 semester)

**DoD Research Thrust:**

- X ORGANIZING – the Force**
- X MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# High Energy Laser Weapons: Modeling and Simulations

**Research Proposal No.: DSE-R-0514**

**Client Organizations:** High Energy Laser Joint Technology Office (HEL JTO);  
AMRDEC

## Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Ed Pogue	HEL Joint Technology Office 901 University Boulevard SE, Suite 100 Albuquerque, NM 87106	505-248-8200	Ed.pogue@osd.mil
Rusty Graves	Aviation and Missile RD&E Center Redstone Arsenal, AL 35898	256-876-4384	
Glen P. Perram Professor of Physics	Department of Engineering Physics Air Force Institute of Technology 2950 P Street Wright-Patterson AFB, OH 45433-7765	937-255-3636 ext 4504	glen.perram@afit.edu

## Problem Description:

The HEL JTO is coordinating the services' efforts to develop high-energy laser weapons. As part of this effort, the JTO recognized the need for end-to-end modeling of such weapons. Physics-based models exist for laser generation, beam formation and control, atmospheric propagation, and target interaction, but the JTO has no available model for a complete laser weapon shot ("photon birth to death"). Higher-level models of a military engagement, the execution of a military mission, or they carrying out of a campaign involving HEL weapons are also unavailable. It is clear that low-level, very detailed, physics-based models need to be linked in some way to higher-level engagement, mission, and campaign models, but it is unclear how this linkage should be worked.

To fill this gap, the HEL JTO asked the two service graduate schools of engineering (AFIT and NPS) and the three service academies (USMA, USNA, and USAFA) to form a consortium to research what modeling is required and to develop a model or family of models to meet the JTO's needs. AFIT agreed to lead this effort and the other institutions agreed to participate in ways appropriate to their capabilities and areas of responsibility.

The objectives of the effort are: (1) to develop a tri-service research team to integrate DoD fundamental research in end-to-end HEL modeling; and (2) to develop a government-owned, DoD-accepted global interface, which integrates existing and future HEL models. The initial focus must achieve a balance between (1) on-going, high-fidelity technical analyses, (2) engineering trade studies, which allow analyses of a wide range of systems, not simply a deep analysis of any one selected system, and (3) analyses of HEL systems' military utility against a broad range of missions.

The lion's share of the effort will be with AFIT, as the institution with by far the greatest expertise and experience with high energy lasers. The participation of USMA will

primarily in evaluating how HELs are or should be modeled in ground warfare and air and missile defense scenarios, and in helping develop linkages from physics-based models to higher-level engagement, mission, and campaign models.

**Proposed Work:**

This is the third year of a five-year, three-phase project. This year the Aviation and Missile Research Development and Engineering Center (AMRDEC) has joined the consortium to provide some Army expertise on high-energy laser systems. We plan to coordinate with them in developing some scenarios for HELCOMES, a laser engagement based on scaling laws being developed by the consortium: AMRDEC will provide the laser parameters, and USMA will provide engagement scenarios and analysis. This project is still in the early stages of definition.

**Requirements and Milestones:** TBD

**Project Deliverables and Due Date:** TBD

**Senior Investigator:** Dr. Roger C. Burk, Ph. D., Associate Professor, USMA - Department of Systems Engineering, 845-938-4754.

**Faculty Analyst:** CPT Eric S. Tollefson, M.S., Instructor, USMA - Department of Systems Engineering, 845-938-5661.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 100 hours

**Principal Analyst:** 100 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# Selecting Portfolios of R&D Projects

**Research Proposal No.: DSE-R-0515**

**Client Organization:** USMA – Department of Systems Engineering

## **Problem Description:**

It is a common problem for a research and development (R&D) manager to have to pick a subset of projects to pursue, i.e. a portfolio, from a larger set of possible R&D projects. This can be a difficult problem for many reasons, the most fundamental of which are the following three key characteristics: (1) Each project has a cost, and there is a total budget constraint, so not all desirable projects can be selected; (2) Different projects may be desirable for different reasons, forcing a tradeoff between competing objectives; and (3) The outcome of each project will generally be uncertain, because of the risky nature of R&D. This problem has been discussed in the technical literatures repeatedly since the 1960s. Members of the D/SE faculty (Parnell and Burk) have helped pioneer a new approach to the problem based on Value Modeling. This has resulted in several successful applications for clients such as the Air Force Research Laboratories and National Reconnaissance Office, which have been reported in scholarly publications. Now this approach needs to be put on a rigorous theoretical foundation and linked to the record of scholarly literature on the problem. This effort will do that, culminating in a peer-reviewed scholarly paper.

## **Proposed Work:**

1. Review and analyze the scholarly literature on R&D portfolio selection
2. Establish position of Value Modeling approach with respect to other approaches
3. Write a paper that lays out the Value Modeling approach in a theoretically sound fashion and links it to the rest of the scholarly literature
4. Present paper at an academic conference
5. Publish in scholarly journal

## **Requirements and Milestones:**

- Paper for conference presentation and publication.

## **Project Deliverables and Due Date:**

- Presentation at INFORMS national meeting: 24-27 Oct 04
- Paper submitted for publication: Jun 2005

**Senior Investigator:** Dr. Roger C. Burk, Ph.D., Associate Professor, USMA - Department of Systems Engineering, 845-938-4754.

**Faculty Analyst:** Dr. Gregory S. Parnell, Ph.D., Professor, USMA - Department of Systems Engineering, 845-938-4374.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 100 Hours

**Principal Analyst:** 10 Hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# Information Quality & Service Reliability

Research Proposal No.: DSE-R-0516

**Client Organization:** OSD, Office of Force Transformation

## Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
COL Gary Agron	OSD, Office of Force Transformation	703.696.5716 DSN 426 Cell: 703.489.6330	gary.agron@osd.mil

## Problem Description:

We undertake a study to develop quantitative metrics based on the concepts of information quality and service reliability for the elements of the NCO CF framework. Specifically, we intend to examine the appropriateness of these metrics using both the case studies developed under contract by OFT and the data resulting from recent C2 experiments.

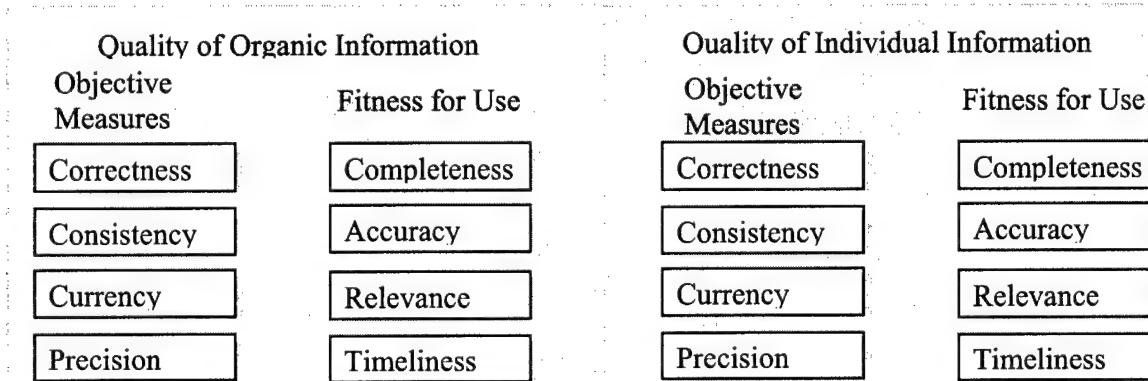


Figure 1. Extract from “Conceptual Framework” briefing by RAND, EBR, dated December 17-19, 2002.

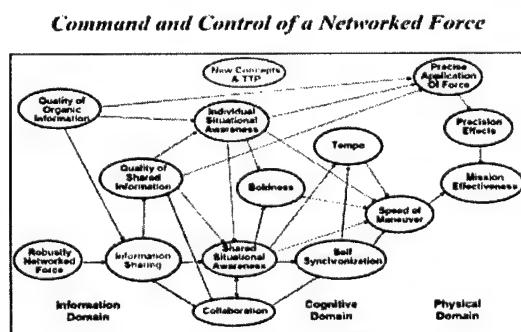


Figure 2. NCO Effects Influence Diagram. Garstka, 2003.

**Proposed Work:**

**Objective 1:** Properly develop a new generalized framework for measuring information quality based on concepts of reliability and network information services that can be applied to elements of the NCO framework.

**Objective 2:** Incorporate into the framework the appropriate service reliability and information manufacturing concepts using the TRADOC sensor network experimental results. Identify and extrapolate their impact on critical dimensions of situational awareness and decision making in the NCO environment.

**Objective 3:** Establish and foster the growth of an NCO Consortium and an Transformation Chair in Dept of Systems Engineering at USMA that will bring together a community of researchers across academic departments and institutions interested in investigating issues associated with NCO Force Transformation.

**Requirements and Milestones:**

- Technical report on results due OFT in April 2005.
- Conduct In-Progress Reviews with OFT or its representatives in May, August, October 2004, and January 2005 to assess status of research.
- NCO Information Quality Workshop to be held at USMA in August 2004 (tentative)
- Share preliminary results at the following professional conferences in FY2004:
  - Joint Conference of the Canadian Operations Research/Institute for Operations Research and the Management Sciences in May 2004.
  - Military Operations Research Society Symposium in June 2004.
  - Operational Research Society (UK) in September 2004.
  - International Command & Control Research & Technology Symposium (Denmark) in September 2004.

**Principal Investigator:** Dr. Patrick J. Driscoll, Ph.D., Professor of Operations Research, USMA - Department of Systems Engineering, 845-938-6587, Dr. Michael Tortorella, Ph.D., Research Professor, Rutgers University - Department of Industrial & Systems Engineering, Dr. Edward Pohl, Ph.D, Associate Professor, University of Arkansas - Department of Industrial & Systems Engineering.

**Resources Required for Project:****Research Hours Required (by position):**

**Senior Investigators:** 100 Hours each

**DoD Research Thrust:**

- X ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- X FIGHTING – the Force**
- SUPPORTING – the Force**

# **Logical Ontology to Assess Information Advantage**

**Research Proposal No.: DSE-R-0517**

**Client Organization:** OSD, Office of Force Transformation

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
COL Gary Agron	OSD, Office of Force Transformation	703-696-5716 DSN 426 Cell: 703-489-6330	<a href="mailto:gary.agron@osd.mil">gary.agron@osd.mil</a>

## **Problem Description:**

We undertake an effort to develop a new quantitative method for assessing the amount of information advantage sensor networks provide Network Centric Forces in support of the goals and objectives of Defense Transformation. Currently, we have developed a generalized battlespace framework for information fusion called a meta-model, capable of estimating a force's operational state given only sensor input. For FY05, we continue to refine this effort, using the best of the performing network learning models in the meta-model framework on friendly operations IAW FM 3-0. By adjusting various settings in our meta-model logical system, we believe that we can accurately represent any degree of information gathering capabilities so that the difference in metric values (to be developed) between friendly and opposing force systems performance characterizes the information advantage afforded by the NCO systems they represent. It will be important to quantify both the degree and rate-of-change of information asymmetry that exists between forces in order to do this.

## **Proposed Work:**

**Objective 1.** To develop a new generalized logical ontology for the NCW/NCO battlespace to examine the issues and effectiveness of a first principles-based structure for detecting operational states in an NCW/NCO environment leading to a quantification for the concept of information advantage/dominance. (Complete)

**Objective 2.** Use a Bayesian Belief Network modified for adaptive learning to create a computer based application to test this new ontology with NCW/NCO-specific military operations. (Complete: BBN, Modal Logic, Fuzzy Logic, and Dempster-Shafer.)

**Objective 3.** Extend the application of this meta-model architecture to be applied to friendly force operations.

**Objective 4.** Develop appropriate static and dynamic metrics to capture the difference between opposing force and friendly force information capabilities so as to measure

the degree and rate of change of information advantage afforded by NCO sensor systems.

### **Requirements and Milestones:**

FY04 (beginning March 2004):

- Define critical objects, rules and metrics required to establish an ontology capable of classifying NCW/NCO battlespace operations.
- Develop a JAVA coded, computer-based application using an adaptive Bayesian Belief Networks to test the effectiveness of this ontology.
- Develop an effective method for dynamically binning battlespace opportunistic information.
- Develop an effective method for using both enumerative and eliminative logic for fusing this information.
- Develop a method for representing the evolution of operational states and conditions leading to measures of information asymmetry.

### **Deliverables:**

- Technical report on results due OFT in April 2005.
- Conduct In Progress Reviews with OFT in October, January, and March.
- Dissemination of results at the following professional conferences (minimum):
  - Joint Conference of the Canadian Operations Research/Institute for Operations Research and the Management Sciences in May 2004.
  - Military Operations Research Society Symposium in June 2004.
  - Operational Research Society (UK) in September 2004.
  - International Command & Control Research & Technology Symposium (Denmark) in September 2004.

### **Timelines:**

**March – June 2004:** initiate research, establish critical communications with OFT suggested sources, begin to define ontology based on established theories linking all operational states and key descriptors to NCW/NCO documentation and appropriate FMs;

**July – Sep 2004:** Define pseudo-code and general structure for implementing learning network logic in a computer-based test application; assess the performance differences of these approaches within the proposed meta-model architecture.

**Oct – April 2005:** Develop automatic means of assessing the degree and rate-of-change for information advantage using the meta-model architecture as described.

**Senior Investigator:** Dr. Patrick J. Driscoll, Ph.D., Professor of Operations Research,  
USMA - Department of Systems Engineering, 845-938-6587.

**Faculty Analyst:** MAJ Steven Henderson, M.S., Instructor & Analysts, Operations  
Research Center of Excellence, USMA - Department of Systems Engineering, 845-  
938-3573.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 30 hours

**Senior Analyst:** 90 hours

**DoD Research Thrust:**

- X ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- X FIGHTING – the Force**
- SUPPORTING – the Force**

# **Using Agent Based Models (ABMs) to determine Soldier Tactical Mission System (STMS) Effectiveness**

**Research Proposal No.: DSE-R-0519**

**Client Organization:** PEO Soldier

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Charlie Tamez	PEO Soldier 5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	703-704-4073 DSN 654-4073	

## **Problem Description:**

**Background:** In order to remain the premier land fighting force in the world, the US Army soldier must be outfitted with the most technologically-advanced equipment possible. However, such equipment is expensive to design, test, evaluate, and implement. Therefore, proposals for such equipment should include a quantitative evaluation of the expected benefit to mission accomplishment that system or component provides the soldier and his unit.

Simulation models are a potential tool for such evaluations. However, the commonly-used simulation models for analytical studies, constructive simulation models, are currently not capable of modeling the advanced soldier interaction and situational awareness that the proposed soldier tactical mission systems (STMS) facilitate.

**Problem:** Program managers need a quantitative methodology to evaluate the benefit to mission effectiveness provided by the STMS as a whole, and by individual or groups of components.

## **Proposed Work:**

Agent-based simulations provide the modeler a potential toolset capable of capturing the interaction between individuals on the battlefield. This project aims to build upon work done during the previous year by developing a methodology for using agent-based modeling to evaluate aspects of STMS effectiveness, to include development of scenarios and appropriate measures of effectiveness (MOEs), design of experiments, analysis of results, and recommendations for future research and software improvement.

## **Requirements and Milestones:**

- IPR November, 2004
- IPR February, 2005

- Final Product May, 2005

**Project Deliverables and Due Date:**

- Interim IPRs: Estimate November, 2004, and February, 2005
- Final Briefing: Estimate May, 2005
- Technical Report: June, 2005

**Senior Investigator:** Dr. Roger C. Burk, Ph.D. Associate Professor, USMA-Department of Systems Engineering, 845-938-4754.

**Faculty Analyst:** CPT Eric S. Tollefson, M. S., Assistant Professor, USMA-Department of Systems Engineering, 845-938-5663.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 1 Hour/week

**Principal Analyst:** 3 Hours/week

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Applying Value-Focused Thinking to Effects Based Operations**

**Research Proposal No.: DSE-R-0520**

**Client Organization:** USMA – Department of Systems Engineering

## **Problem Description:**

Currently the Department of Defense uses a form of value modeling to determine how to “best” approach tactical and operational missions in combat and OOTW environments (i.e. Afghanistan, Iraq, etc.). There are potential flaws in the technique the DoD employs which this research will identify. Additionally, this research will propose an alternative methodology to evaluate Effects Based Operations using a value focused framework.

## **Proposed Work:**

Identify actual EBO scenario that incorporates flawed evaluation methodology and apply value-focused thinking to demonstrate utility of VFT methodology in EBO.

## **Project Deliverables and Due Date:**

- Journal Paper for INCOSE/INFORMS/MORS (Jan 05)
- Technical Report for DTIC (Jan 05)
- Presentation at conference in FY05

**Senior Investigator:** Dr. Gregory Parnell, Ph. D., Professor, USMA – Department of Systems Engineering, 845-938-4374.

**Faculty Analyst(s):** MAJ Robert Keeter, M. S., Instructor, USMA – Department of Systems Engineering, 845-938-4857.

## **Resources Required for Project:**

### **Research Hours Required (by position):**

**Senior Investigator:** 10 hours

**Principal Analyst:** 40 hours

## **DoD Research Thrust:**

### **X ORGANIZING – the Force**

- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Capabilities Based Readiness Metric**

**Research Proposal No.: DSE-R-0522**

**Client Organization:** USMA – Department of Systems Engineering

## **Problem Description:**

Senior civilian DOD undersecretaries have been asking for new readiness metrics that have more meaning for planning military operations than the metrics currently reported by the Air Force, Army and Navy.

## **Proposed Work:**

Background interviews have already been conducted, problem diagnosis has been done, a measure and model have been encoded in excel, and a paper has been written which has been nominated for the Barchi prize. The paper has been given to modelers and planners in DOD who have responsibility for change in the Army Readiness Reporting System. We plan to interview these individuals, respond to their critiques, correct defects in the optimization model we have implemented, write the Barchi prize paper submission, and develop a roadmap to implement our results world wide in the army.

## **Requirements and Milestones:**

- November 21, 2004 submit Prize paper.
- August 1, 2005: submit roadmap to Dr Laura Junor , DOD office of Personnel and Readiness.

## **Project Deliverables and Due Date:**

- Interim IPRs: none
- Final Briefing: August 1, 2005
- Technical Report: Oct 1 , 2005

**Senior Investigator:** Dr. Bobbie L. Foote , Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893.

**Faculty Analyst(s):** CPT Steven Henderson, M.S., Instructor and Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-3573, MAJ William Kaczynski, M.S., Instructor, USMA – Department of Mathematical Sciences, 845-938-2276.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 80 hours ( 2/week)

**Principal Analyst:** 100 hours (2/week for both)

**DoD Research Thrust:**

**X ORGANIZING – the Force**

- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Computing Probability of Mission Planning and Execution Success**

**Research Proposal No.: DSE-R-0523**

**Client Organization:** USMA - Department of Systems Engineering

## **Problem Description:**

Can the experience and training record along with time elapsed since last training or execution allow a computation of the probability that a given mission will be successfully executed?

## **Proposed Work:**

We will explore some basic models of team task word beginning with PERT/CPM and continuing with an analysis of a simulation model of CPM by Prof Ricky Ingalls of Oklahoma State University

## **Project Deliverables and Due Date:**

We hope to develop a paper describing a process to model and achieve this probability calculation by Oct 1 2005. We hope this paper will be the basis of a proposal to TRADOC.

- Interim IPRs: Lecture by Professor Ingalls
- Final Briefing: Oct 1, 2005
- Technical Report: Oct 1, 2005

**Senior Investigator:** Dr. Bobbie L. Foote , Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893.

**Faculty Analyst(s):** COL William K. Klimack, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4698.

## **Resources Required for Project:**

### **Research Hours Required (by position)**

**Senior Investigator(s):** 2 hours/week

**Principal Analyst:** 2 hours/week

## **DoD Research Thrust:**

- ORGANIZING – the Force**

- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Blackboard Usage Analysis and Grades Correlation**

**Research Proposal No.: DSE-R-0524**

**Client Organization:** USMA – Department of Systems Engineering

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Jeffrey Rohrlick (POC for Blackboard data)	SEB, USMA	845-938-4670	Jeffrey.Rohrlick@usma.edu
Edith Irwin (Informal Client)	Chief, Software Engineering Information & Educational Technology Division United States Military Academy	845-938-7442	Edith.Irwin@usma.edu
Jim McKelvey (POC for Grades data)	ORD\Dean, USMA	845-938-6327	James.Mckelvey@usma.edu
Anita Gandalfo (Informal Client)	Director, Center for Teaching Excellence United States Military Academy	845-938-6155	Edith.Irwin@usma.edu

### **Problem Description:**

Currently, USMA is not tracking department level or course-type usage of Blackboard as a teaching resource. There have been no attempts to quantitatively gauge the effectiveness of Blackboard as an educational resource for cadets, nor does the Academy have visibility of cadet usage profiles of this system.

### **Proposed Work:**

Assess the density of courses at the Academy that are currently utilizing Blackboard and investigate whether Math/Science/Engineering departments or courses tend to use Blackboard more frequently than Humanities/Public Affairs type departments and courses. Further, mine Blackboard data to determine usage trends associated with various cadet groups defined by graduating class, corps squad membership, etc., in order to answer questions such as:

- Do Plebes use Blackboard more or less than upper class cadets?
- Do Corps Squad athletes tend to use Blackboard more or less than other cadets?
- Do Corps Squad athletes tend to use Blackboards during later hours than other cadets?
- How is Blackboard use effected by home football games?
- Is there a reduction in Blackboard use or post-midnight use now that there is a new mandatory lights-out policy in effect?

- Is there a correlation between Blackboard use and higher academic grades within Blackboard supported courses?

**Requirements and Milestones:**

- Gain access approval to proprietary Blackboard data for AY04 – approval granted and technical support offered by SEB.
- Gain access to academic grade data for AY04 – support offered by ORD.
- Determine schema/structure of Blackboard database in order to ascertain the type of data (fields) that are available.
- Join Blackboard data to ORD data.
- Finalize analysis of AY04 Blackboard data NLT conclusion of AT05-1.
- Finalize analysis of AT05-1 Blackboard data NLT 1 March 05.
- Complete research report NLT 1 April 05.

**Project Deliverables and Due Date:**

- Interim IPRs: Expected dates, 15 Oct 04.
- Final Briefing: o/a 15 April 05.
- Technical Report: NLT 20 April 05.

**Senior Investigator:** LTC Michael J. Kwinn, Jr., Ph. D., Associate Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

**Faculty Analyst(s):** LTC Veronica S. Zsido, M.S., Instructor; USMA – Department of Systems Engineering, 845-938-5206, MAJ Grant Martin, Instructor and Analyst; Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5661, CPT Steven Henderson, Instructor & Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-3573.

**Supporting Laboratory Technician:** Blackboard database technical support will be provided, at no cost, by Mr. Jeffrey Rohrlick, Instructional Technologist, SEB

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 40 Hours

**Faculty Analysts:** 70 hrs

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Interleaving Discretization & Learning to Improve Identification and Accuracy of Inference Estimates in Learning Networks**

**Research Proposal No.: DSE-R-0526**

**Client Organization:** TBD

## **Problem Description:**

The principal focus of this research effort is to determine whether interleaving discretization of continuous variables with the learning of structure in digital information systems improves structure identification accuracy and classification accuracy. Demonstrating this to be the case would represent an improvement over current methods, principally automated methods that incorporate inductive algorithms for learning.

We will apply interleaving discretization of continuous variables with learning a BN to the Army's Base Realignment and Closure (BRAC) historical data from 1988 to 1995. The development of a method to model the BRAC data as a automated learning model offers a natural way to represent the uncertainties associated with the data when dealing with planning and prediction of base closing and disposition times. Achieving this objective will result in a model or models that can assist the BRAC leadership in making decisions to achieve the BRAC goals and to investigate other influences on base closure and disposition times

## **Proposed Work:**

**Objective 1:** Determine whether interleaving discretization of continuous variables with learning of structure in digital information systems improves structure identification accuracy and classification accuracy.

**Objective 2:** Demonstrate an application of the proposed interleaving structure on a real world problem and data set originating from the Army's Base Realignment and Closure (BRAC) historical data from 1988 to 1995.

## **Deliverables:**

- Dissertation Defense at George Mason University in May 2005.
- Dissemination of results at the following professional conferences (minimum)
  - Institute Dissertation for Operations Research and the Management Sciences in Oct 2005
  - Military Operations Research Society Symposium in June 2005

**Timelines:**

**Sep – Dec 2004:** defend research proposal at George Mason University, complete development of test application, apply methodology to recognized test data sets, analyze results, adjust methodology as appropriate.

**Jan – March 2005:** Apply methodology to U.S. Army BRAC data, analyze results.

**April – May 2005:** Complete dissertation write up, preparation for defense and formal defense of research.

**Senior Investigator:** Dr. Patrick J. Driscoll, Ph.D., Professor of Operations Research, USMA - Department of Systems Engineering, 845-938-6587.

**Faculty Analyst:** LTC Pamela Hoyt, M.S., USMA - Dept of Systems Engineering, 845-938-2788.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 30 hours

**Senior Analyst:** 120 hours

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

**X EQUIPPING – the Force**

**FIGHTING – the Force**

**SUPPORTING – the Force**

# **Development of a Data Collection Strategy In Support of PEO Soldier Simulations**

**Research Proposal No.: DSE-R- 0527**

**Client Organization:** PEO-Soldier

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
TBD			

## **Problem Description:**

**Background:** PEO Soldier often relies upon modeling and simulation as the basis for acquisition decision-making. Their models are specifically focused, as much as possible, at the soldier-level of resolution. Unfortunately, the data supporting those simulations – especially at the soldier level – is often not available. More complete, accurate data would greatly enhance the validity and realism of the simulation, resulting in a more informed decision. Simulation proponents recognize this and do their best to use their best estimates of required data, or identify proxy measures to use in their place. At the same time though, Army units and agencies conduct exercises and studies which could provide those necessary types of data. In this study, we propose to employ the Systems Engineering Management Process (SEMP) to develop an overall strategy for identifying the data required and then identifying those initiatives which could provide that data. The SEMP is a robust, deliberate problem solving methodology taught in the Department of Systems Engineering at the United States Military Academy. It has been used widely in a variety of applications, both on military and commercial problems. The SEMP has recently been employed in development of an operational assessment system for Operation Enduring Freedom, in support of the Base Realignment and Closure (BRAC) study group, and to analyze the regional structure of the Army Installation Management Agency.

**Approach:** The first step in this process is identifying the simulation models PEO Soldier uses in their acquisition decision-making process. Establishing those early will allow the study to focus on specific needs of those developers and will result in a product that is targeted directly back to PEO Soldier's needs. The next step is to contact those simulation proponents and find out what gaps exist in their data. These gaps can be either a statistic for which they have no supporting data, or one for which the data is insufficient. Using the SEMP and based on our stakeholder interviews, we will develop a value for each of those gaps. This information will provide our basis for analyzing the overall data needs.

Once we develop a list of data gaps, prioritized by PEO Soldier (with the developers' input), we will begin generating alternatives which could fill in the gaps. These alternatives will be a list of existing initiatives or studies from around the country which will provide the data needed to fill in the gaps.

PEO Soldier and the simulation developers must then jointly determine which of the identified methods will best address their data needs. We would then become a source of information, facilitating the connection between PEO Soldier, simulation proponent and the agency or unit conducting the study.

**Conclusion:** PEO Soldier equips, arms and protects American soldiers. To do so, PEO Soldier must depend on modeling and simulation for analysis in support development and decision-making related to soldier systems. That modeling and simulation must be based on the best data sources available. This study will develop the overarching strategy to identify and connect those critical gaps in the data with a potential source for the missing information.

### **Proposed Work:**

Tasks to be performed and issues to address:

1. Needs analysis
  - a. Conduct stakeholder interviews with PEO Soldier to determine which types or platforms of modeling and simulation they use in decision-making.
  - b. Conduct interviews with those simulation proponents to determine the gaps in their data.
  - c. Develop a value-based list of those gaps.
  - d. Conduct briefing with PEO Soldier outlining the proponents' gaps and the value of each (IPR).
  - e. Conduct a review of studies conducted across the Army, to include but not limited to:
    - (a) CALL initiatives
    - (b) TRADOC studies
    - (c) CTC initiatives
  - f. Based on the purpose and method of those studies, identify those which would help fill the data gaps.
  - g. Act as a liaison between PEO Soldier, the simulation proponents and the study directors for exchange of information.

### **Requirements and Milestones:**

MILESTONE	DATE
Identify primary PEO Soldier modeling and simulation platforms	20 September
Conduct interviews with M&S proponents	15 November
Develop value-based list of gaps in the data, present in IPR to PEO Soldier	1 December

Review Army studies or initiatives	15 February 2005
Identify connections between Army studies and gaps in the data and brief those connections to PEO Soldier and proponents	15 March 2005

**Project Deliverables and Due Date:**

<u>Item</u>	<u>NLT</u>
Value-based list of gaps in simulation data in IPR to PEO Soldier	1 December 2004
Briefing to PEO Soldier and simulation proponents	15 March 2005
Technical report	July 2005

**Senior Investigators:** LTC Jeffrey B. Schamburg, Ph.D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5539.

**Faculty Analysts:** MAJ Grant Martin, M.S., Instructor and Analyst, Operations Research Center of Excellence, USMA - Department of Systems Engineering, 845-938-5661.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 40

**Principal Analyst:** 300

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **National Academies Study on Complex Future of Models and Simulations (M&S)**

**Research Proposal No.: DSE-R-0528**

**Client Organization:** Defense Modeling and Simulation Office (DMSO)

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Scott Weidman	Director, Board on Mathematical Sciences and their Applications The National Academies 500 Fifth Street NW Washington, DC 20001	202-334-2421	SWeidman@nas.edu
Mr. Jack Sheehan	Defense Modeling and Simulation Office Alexandria, VA	703-998-0660 x448	Jack.Sheehan@osd.mil

### **Problem Description:**

The National Research Council is beginning an ambitious study for the Defense Modeling and Simulation Office that aims to provide technical guidance about how the modeling and simulation (M&S) community can assemble different sorts of models and simulations to produce trustworthy information for strategic decision-makers.

### **Proposed Work:**

The purpose of the study will specifically address the following goals:

- Develop an overall conceptual plan by which the M&S community can create the capability for modeling systems of systems;
- Evaluate current capabilities and methods for linking disparate M&S components against the goals for Defense Transformation, so that the overall model is semantically consistent (that is, the component M&S tools are employing the same basic, consistent assumptions about the environment);
- Formulate recommendations for how to incorporate into M&S outputs information about, and assessments of, (a) the effects that the force structure and flow of information assumed in a model have on military measures of effectiveness, and (b) risk in decision making (e.g., probabilistic estimates of the consequences of various decisions given the environment and information at hand); and
- Identify research and development (R&D) tasks and, possibly, organizational changes required to overcome shortfalls.

### **Requirements and Milestones:**

The initial kickoff meeting will be held October 5-6, 2004 at the headquarters of the Defense Modeling and Simulation Office (DMSO) in Alexandria, VA. Day 1, October 5, will involve briefings from a wide range of military leaders describing the sorts of strategic decisions they face and how they use, or would hope to use, the results of models and simulations to inform their decisions. On the 6<sup>th</sup>, the group will meet more privately to clarify the goals and plans for the study and identify the right mix of expertise to involve as we initially scope the problem.

In order to conduct this study, the National Research Council will assemble a committee of approximately 15 experts with expertise spanning operations research, computational science, mathematical sciences, military modeling, decision science, and human performance modeling. Through a series of about five meetings, plus site visits, the committee will examine the range of M&S tools currently in use or under development, develop an analysis of the technical and conceptual issues of importance to the four objectives above, and make appropriate recommendations. The committee will be supported by staff that will develop meeting plans, assemble background information for the committee, serve as liaison to relevant organizations and experts, and ensure that the study is completed on time and within budget.

**October 2004, Meeting #1.** The broad group of experts, some of whom will later be appointed to the study Committee, will assemble to be briefed by the sponsor and leaders in the use of M&S for Defense Transformation; learn about the range of military M&S and related studies; clarify the scope and plans for the study; and identify additional expertise needed by the Committee.

**November or December 2004, Committee meeting #2.** The Committee learns more about technical issues, hears from specific experts, develops its thoughts about how to think about and weigh options, identifies site visit needs, and outlines its report.

**Winter and Spring 2005:** Site visits. Committee members, in small groups, make 4-5 site visits (typically just one site visit per committee member) to examine examples of various military M&S operations. Site visits might include, for instance, a service training systems organization, the Army's Institute for Creative Technologies, a field exercise site, a T&E center that relies on virtual tools, and DOD's Office of Program Analysis and Evaluation.

**Spring 2005, Committee meeting #3.** The Committee learns more about technical issues, hears from additional experts, and develops preliminary findings related to the study objectives. Report drafting begins after this meeting.

**Summer 2005, Committee meeting #4 and public workshop.** Committee holds a small workshop to explore integration, compatibility, visualization, and interpretation issues stemming from the composition of different M&S modes. This workshop will provide participants with an opportunity to discuss conceptually how to build the capability for modeling systems of systems, and it will provide an opportunity for the Committee to discuss its preliminary ideas with leaders of the military M&S community. In closed session, the Committee will develop consensus findings and recommendations. Writing continues after this meeting.

**October or November 2005, Committee meeting #5.** Committee finalizes its results, plans how to improve its draft report, plans report dissemination and study follow-through.

**December 2005-January 2006.** Report is peer reviewed, edited, and printed

**January 2006.** Report is released, with follow-up briefing(s) as needed.

**Project Deliverables and Due Date:** Specific milestones for project deliverables TBD

**Senior Investigator:** COL Mike McGinnis, Ph. D., Professor & Head, USMA – Department of Systems Engineering, 845-938-2701.

**Faculty Analyst(s):** Dr. Niki Goerger, Assistant Professor, USMA – Department of Systems Engineering, 845-938-3180; MAJ Robert Keeter, M. S., Instructor, USMA – Department of Systems Engineering, 845-938-4857.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 50 hours x 2 = 100 hours

**Principal Analyst:** 100 hours x 2 = 200 hours

**DoD Research Thrust:**

- X ORGANIZING – the Force**
- X MANNING – the Force**
- X TRAINING – the Force**
- X EQUIPPING – the Force**
- X FIGHTING – the Force**
- SUPPORTING – the Force**

## **Acquisition Modeling and Simulation Working Group (AMSWG)**

**Research Proposal No.: DSE-R-0529**

**Client Organization:** Office of the Secretary of Defense (Acquisition, Technology and Logistics) (OSD (AT&L)) senior level Systems Engineering (SE) Forum

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Dr. Glenn F. Lamartin	Office of the Under Secretary of Defense Director of Defense Systems, SE FORUM		

### **Problem Description:**

Advance the understanding and utility of modeling and simulation (M&S) across the acquisition process, with emphasis on meeting the challenges associated with Department of Defense (DoD) commitment to capability-based acquisition for systems, systems-of-systems (SoS), and families-of-systems (FoS).

### **Proposed Work:**

Interest and activity will include: review and develop M&S policy, processes, investments, tools, infrastructure, technology, workforce education, and standards to facilitate systems, System of Systems (SoS), and Family of Systems (FoS) engineering, to include test and evaluation, across the acquisition life-cycle and integrated with other communities of interest (such as analysis, training, etc).

1. Identify M&S capabilities that will enable it to serve as a core enabler and integral element of SoS and FoS acquisition.
2. Identify and overcome challenges in M&S to support SoS and FoS engineering processes, to include test and evaluation, and make recommendations for effective, focused solutions, including revising policy.
3. Promote a culture for long-term M&S strategies in acquisition.
4. Work with other activities (such as Defense Modeling and Simulation Office (DMSO)) to assure synchronization and coordination of functional domain M&S plans.

### **Requirements and Milestones:**

- Assessment of the current state of M&S in support of acquisition
- An Acquisition M&S Master Plan as required by the DoD M&S Master Plan

- Proposed policy and guidance changes
- Long term strategy to make M&S an integral element of SoS and FoS acquisition

**Project Deliverables and Due Date:**

The AMSWG will report to the DoD senior level SR Forum on a quarterly basis as a minimum. Specific milestones TBD.

**Senior Investigators** COL Mike McGinnis, Ph. D., Professor & Head, USMA – Department of Systems Engineering, 845-938-2701 and Dr. Niki Goerger, Assistant Professor, USMA – Department of Systems Engineering, 845-938-3180.

**Faculty Analyst:** MAJ Rob Keeter, M. S., Instructor, USMA – Department of Systems Engineering, 845-938-4857.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 50 hours x 2 = 100 hours

**Principal Analyst:** 20 hours

**DoD Research Thrust:**

- X ORGANIZING – the Force**
- X MANNING – the Force**
- X TRAINING – the Force**
- X EQUIPPING – the Force**
- X FIGHTING – the Force**
- SUPPORTING – the Force**

# **Force Scheduling Decision Support Requirements**

**Research Proposal No.: DSE-R-0530**

**Client Organization: FORSCOM G3**

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Larry Nix	Chief of Analysis Modeling, & Simulation G3 Plans, FORSCOM HQ	404-464-7425	nixl@forscom.army.mil
MAJ Geoff Coleman	Analyst, Analysis, Modeling, & Simulation G3 Plans, FORSCOM HQ	404-464-5617	colemangk@forscom.army.mil

## **Problem Description:**

Current Request For Forces (RFF) decisions require the FORSCOM G3 staff to use labor-intensive, manual analysis methods. These methods are time-consuming and provide only near term impacts for proposed decisions. Using On-Line Analytical Processing (OLAP), the FORSCOM G3 has developed the FORSCOM Sourcing Tool (FST). The FST requires human analysts to manipulate data for specific decision requirements and provides a current snapshot of decision consequences. Considering future force structure, future requirements, and future decisions, the FORSCOM G3 wants to consider feasible analytical alternatives that will improve decision making.

## **Proposed Work:**

The purpose of this research is to determine force scheduling decision support requirements and to develop a recommended course of action for development of an improved force scheduling decision support capability. To accomplish our research task, we will apply the Systems Engineering and Management Process (SEMP), specifically focusing on the Problem Definition phase. This includes a needs analysis, a functional breakdown for decision support requirements, and an analysis of the objectives of the problem.

The primary deliverable from our research will be a detailed Revised Problem Statement based on our analysis in the Problem Definition phase of the SEMP. This will include a detailed description of the objectives of the system and an identification of the system's functional requirements. Finally, we will provide our recommendation as to the future direction of the research and how the client should proceed for development of an improved force scheduling decision support capability.

### **Requirements and Milestones:**

MILESTONE:	DATES:
Stakeholder Interviews	Oct-Nov 04
Background Research (Current System and Related Military and Commercial Analytical Methods/Capabilities)	Oct-Nov 04
In-Progress Review (IPR)	Dec 04
Revised and Scoped Problem Statement	Dec-Jan 05
Course of Action Development	Jan-Feb 05
Recommendation and Final Project Briefing	Mar 05
Technical Report Complete	Mar 05

### **Project Deliverables and Due Date:**

- IPR: Dec 04
- Final Briefing: Mar 05
- Technical Report: Mar 05

**Senior Investigator and Primary Analyst:** LTC Jeffrey B. Schamburg, Ph.D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5539.

### **Resources Required for Project:**

#### **Research Hours Required (by position):**

**Senior Investigator/Principal Analyst:** 600 Hours

### **DoD Research Thrust:**

#### **X ORGANIZING – the Force**

- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**

#### **X FIGHTING – the Force**

- SUPPORTING – the Force**

# **Validation Methodology for Human Behavior Representation Models**

**Research Proposal No.: DSE-R-0531**

**Client Organization:** USMA - Department of Systems Engineering

## **Problem Description:**

The Department of Defense (DoD) continually pursues new modeling and simulation capabilities to meet the training and analytical needs of the U.S.'s military establishment. Improvements to the fidelity of physics-based models have raised expectations for modeling human behaviors. However, the lack of verified data has made validating human behavior models difficult.

Although validation of physics-based models is well-defined using long-established standards, the practices are not well suited for validating behavioral models. This is due to several factors:

- The nonlinear nature of human cognitive processes (Department of Defense Directive, 2001);
- The large set of interdependent variables making it impossible to account for all possible interactions (Department of Defense Directive, 2001);
- Inadequate metrics for validating HBR models;
- The lack of a robust set of environmental data to run behavioral models for model validation; and
- No uniform, standard method of validating cognitive models.<sup>1</sup>

## **Proposed Work:**

The objectives of my dissertation research were to (a) presents a methodology for validating HBR model implementations for use in Department of Defense training and research models and simulations and (b) mitigate issues regarding validation and use of HBR models implemented in legacy and emergent combat simulations. A vital component of the research included development of a research agenda for future research derived from questions and directions during the execution of the research. The objectives of the proposed work are to continue the analysis and presentation of research conducted for my dissertation in the area of assessment of subject matter experts in the validation of human behavior models and fuel the research agenda started in the dissertation. I propose to submit my work to three forums/conferences (2005 Conference on Behavior Representation in Modeling and Simulation (BRIMS), Interservice/Industry Training,

---

<sup>1</sup> Cognitive models "describe the detection, storage, and use of information" (Solso, 2001). This refers to models that simulate the human thought process to select actions for execution during a simulation.

**Simulation and Education Conference (I/ITSEC), and European Simulation Interoperability Workshop (Euro-SIW))** and submit my research to at least one refereed journal. The benefits the Department of Defense by providing better human behavior representation models for use in training and the decision making process through more accurate and consistent assessment of model performance.

**Requirements and Milestones:**

- Acceptance of Abstract and Paper for I/ITSEC (July 2004)
- Identify appropriate refereed journal to submit paper to 01 October 2004
- Abstract and Paper Requirements for BRIMS 2005 are not yet posted (Due Fall 2004)
- Abstract and Paper Requirements for Euro-SIW 2005 are not yet posted (Due Fall 2004)

**Project Deliverables and Due Date:**

- Final Paper (I/ITSEC): 24 September 2004.
- Final Presentation (I/ITSEC): 01 October 2004.
- Presentation (I/ITSEC): 06-09 December 2004.

**Senior Investigator:** LTC Simon Goerger, Ph. D., Instructor, USMA – Department of Systems Engineering, 845-938-5535.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 250 Hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## Distributed Sensor Network (DSN) Simulation Model

Research Proposal No.: DSE-R-0532

**Client Organization:** Sensor and Electron Devices Directorate, Army Research Lab,  
Adelphi, MD 20783

### Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. John Eicke	Director, Signal and Image Processing Division Sensor and Electron Devices Directorate Army Research Laboratory Adelphi, MD 20783-1197	301-394-5000 ext. 2626	jeicke@arl.army.mil
Dr. Nino Srour	Chief, Battlefield Acoustics Branch Signal and Image Processing Division Sensor and Electron Devices Directorate Army Research Laboratory Adelphi, MD 20783-1197	301-394-2623	nsrour@arl.army.mil
Dr. Tien Pham	Team Leader, Acoustic Signal Processing Branch Signal and Image Processing Division Sensor and Electron Devices Directorate Army Research Laboratory Adelphi, MD 20783-1197	301-394-4282	tpham@arl.army.mil

### Problem Description:

The Sensor and Electron Devices Directorate (SEDD) of the Army Research Laboratory (ARL), one of the principal Army organizations for research and development in sensors and electron devices, is currently conducting extensive research in the area of distributed sensor networks (DSNs). DSNs are sensor fields consisting of intelligent, disparate sensors that are distributed spatially and geographically. Most DSNs include remote, unattended sensors, assets which create new capabilities but also introduce new constraints on power and communications resources. These constraints have created a renewed interest in developing sensor management strategies that increase the efficiency of DSN operations.

For my PhD research, I proposed and evaluated an approximate dynamic programming approach that balanced sensor network performance against power consumption to identify efficient DSN operating policies. I briefed representatives from SEDD on my findings and they expressed an interest in additional research into DSN sensor management strategies. In addition, there are a number of sensor research projects ongoing within the department.

To support my PhD research, I developed a DSN simulation model, called SNOOPS. This model currently handles a single stationary target and does not integrate terrain effects on sensing capabilities or communications. In order to continue my investigation of sensor management issues, and to support other department sensor research projects, I need to increase the robustness and fidelity of the simulation model.

**Proposed Work:**

- a. Coordinate with SEDD to identify and prioritize sensor management issues for investigation.
- b. Coordinate with other department sensor researchers to identify and prioritize DSN simulation needs.
- c. Consolidate these requirements and compare with current SNOOPS capabilities to identify and prioritize necessary model improvements.
- d. Implement the identified model improvements. Anticipated improvements include the ability to handle multiple targets, moving targets, and varied sensing modalities; the implementation of terrain effects in sensing capabilities and communication; and the development of a Graphical User Interface (GUI) to facilitate use of the model by other sensor researchers.
- f. Prepare a written technical report to serve as the de facto "User Manual" for the SNOOPS DSN simulation model.

**Requirements and Milestones:** TBD

**Project Deliverables and Due Dates:**

- IPR: Dec 04
- MORSS Presentation: Jun 05
- Technical Report: Aug 05

**Senior Investigator:** LTC William S. Bland, Ph. D., Assistant Professor, USMA – Department of Systems Engineering 845-938-5181.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator/Principal Analyst:** 160 (4 hrs/wk for 2 semesters)

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**

**X FIGHTING – the Force**

**SUPPORTING – the Force**

## Tactical Ground Information Domain (T-GrID) Analytical Support

Research Proposal No.: DSE-R-0533

**Client Organization:** Computational and Information Sciences Directorate, U.S. Army Research Laboratory

### Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Dr. Windell Ingram	Tactical Ground Information Domain Program U.S. Army Research Laboratory Adelphi, MD 20783-1197	301- 394-0168	wingram@arl.army.mil
Mr. Randy Woodson	Tactical Ground Information Domain Program U.S. Army Research Laboratory Adelphi, MD 20783-1197	301- 394-1816	rwoodson@arl.army.mil

### Problem Description:

The Army Research Laboratory's Tactical Ground Information Domain (T-GrID) provides a common operating picture that aims to improve situational awareness of dismounted forces. It will enable remote users to access the ground picture, language translation capabilities, and databases of previously translated documents. T-GrID amplifies the ground picture by providing the dismounted soldier intelligent retrieval of information from the collateral space, combined with semi-automated data fusion (sense-making). It is expected that T-GrID will play a critical enabling role in FY05 for both the Horizontal Fusion (HF) portfolio and our military forces supporting U.S. interests abroad. T-GrID supports Joint Operations Concepts Battlespace Awareness with sense-making capabilities which enable the platoon leader or company commander to act upon actionable intelligence received from organic sources and from the MARS portal during the course of a mission. Furthermore, T-GrID aims to make every soldier a sensor and to employ an array of integrated organic software and hardware which are adaptable to multiple platforms at the tactical level. Technologies consist of an array of mobile, vehicle-mounted and pre-positioned sensors, supported through a secure wireless network tied in through a Local Fusion Node (LFN) to the collateral space.

The primary deliverables for T-GrID include the LFN, the Army Collateral Space Node (ACSN), the Secure Mobile Network (SMN), and the Net-Centric Basic Language Translation Services (NetBLTS). The Local Fusion Node is the hub for acquisition, processing and dissemination of information used by and provided by a platoon and its organic assets. The ACSN fuses data from local, ground-truth sources and global or theater sources alike, in near-real time. Advances in HF05 will provide improved situational awareness to the soldier and a ground perspective to higher echelons. Soldiers will receive alerts tailored to their location and situation and will be able to quickly pull information that triggered the alert. The SMN provides the secure, wireless communications backbone for organic platforms and sensors. This secure communication infrastructure will enable a

fully mobile, fully communicating, agile, and situation-aware force that can collaborate with local and national users. SMN supports streaming video, voice over IP (VoIP), transmitted document snapshots for machine translation, images, text, and access by the soldier to the LFN and through the LFN to Collateral Space. The NetBLTS serves machine translation of foreign language information to analysts at desktops and platoon leaders with laptops linked via the LFN. Users can input electronic or scanned paper documents via the MARS portal and receive approximate English translations within seconds.

One of the issues involved with the final development and fielding of the T-GrID concepts, as with most new types of military technologies, is that there is little knowledge of how to employ the new systems effectively in combat. This is because initial employment concepts are based more on factors related to the physical attributes, characteristics, and direct capabilities of the new systems and not based on factors related to their impact on mission success in combat. Employment concepts should be considered in the full scope of military operations, especially difficult combat operations. Although it is believed that future military operations will gain a marked advantage through advances in T-GrID capabilities, we do not know how these concepts will affect the soldier or small unit operations. Basically, we do not know the best way to take advantage of these potential improvements in combat. Furthermore, we do not know which information related factors have the strongest impact on mission success. Gaining this understanding is important because T-GrID managers (and other related program managers) need to know how their programs impact mission success and which technological factors are the most important in determining success. Furthermore, this understanding will improve decision making for resource allocation in future development.

### **Proposed Work:**

This work aims to increase understanding of the relationships between T-GrID related factors, procedural factors, and mission success. The purpose of this work is threefold. First, this work will provide insights as to which T-GrID related capabilities are the most important to the war-fighter in order to ensure mission success. This will provide direct input to T-GrID needs analyses. Furthermore, it will improve decision making related to further T-GrID developments, enhancements, and refinements. Second, considering these new information capabilities, this work will provide insights for the proper employment of forces and new equipment. These insights will also provide direct input to T-GrID needs analyses. Additionally, these insights will enhance operational activation of T-GrID related capabilities. Finally, this work will provide an exploratory analysis to help direct test and integration activities and further experimentation.

To accomplish this analysis, we will use modeling and simulation approaches for representation of the developed scenarios and the Modified Response Surface Methodology (MRSRM) for analysis of the resulting data. The aim of this work is to look at tradeoffs in potential ACSN, LFN, SMN, and NetBLTS related factors and tactical procedural related factors at the same time. The purpose of doing this is to get a better understanding of the true tradeoffs involved. Additionally, we want to develop some "rules of thumb" which may provide the insights as to how war-fighters and small units might operate with these future information technologies. This work will focus primarily on T-GrID technologies and small unit operations. Initial issues for analysis include:

- a) How do key information capabilities affect the outcome? What T-Grid related information parameters are the most important and what improvement do they provide?
- b) What are the implications for small unit tactical procedures and employment of organic T-Grid technologies (sensors, LFN mules, NetBLTS mules)?

**Requirements and Milestones:**

MILESTONE:	DATES:
Stakeholder Interviews	Oct-Nov 04
Scenario Development and Simulation Preparation	Oct-Nov 04
In-Progress Review (IPR)	Dec 04
Conduct Simulation Experiments and Analysis	Jan-Mar 05
In-Progress Review (IPR)	Mar 05
Follow-up Experiments as Necessary	Apr 05
Final Presentations	May 05
Technical Report Complete	June 05

**Project Deliverables and Due Dates:**

- IPR: Dec 04
- IPR: Mar 05
- Final Briefing: May 05
- Technical Report: June 05

**Senior Investigator and Primary Analyst:** LTC Jeffrey B. Schamburg, Ph.D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5539.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator/Principal Analyst:** 1000 Hours

**Lab Use Hours:** 96 Hours (any lab, after class hours)

**Laboratory Technician Hours:** 48 Hours (any lab, after class hours)

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**

- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Command and Control (C2) Metrics for Small Unit Operations in Urban Environments**

**Research Proposal No.: DSE-R-0534**

**Client Organization:** Command and Control in Complex and Urban Terrain Science and Technology Objective, Computational and information Sciences Directorate, U.S. Army Research laboratory

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Gary Yerace	Science and Technology Objective (STO) Manager Command and Control in Complex and Urban Terrain U.S. Army Research Laboratory Adelphi, MD 20783-1197	301-394-1317	gyerace@arl.army.mil
Mr. Al Sciarretta	CNS Technologies, Inc.	703-517-2143	asciarretta@unconventional-inc.com

### **Problem Description:**

The Command and Control in Complex and Urban Terrain (C2CUT) Science and Technology Objective (STO) will develop C2 capabilities that provide Future Force dismounted and mounted commanders and soldiers with enhanced, revolutionary information collection/management, planning, and decision aids to support close combat and stability operations in complex and urban terrain. The C2CUT STO involves a broad range of technologies and concepts to include: 3 dimensional shared displays; mixed asset controls; robotic sensors; algorithms and programs to give visual representation of opposing forces; S2 displays; decision aid analysis; MOUT data mining; human factors analysis; decision-making with collaborative teams; mission planning and execution software systems; and weather modeling and display systems.

One technical barrier within the C2CUT STO is the inadequacy of current metrics to evaluate the effectiveness of enhanced C2 capabilities in support of humans and teams engaged in complex and urban warfare. Given the broad range of technologies and concepts involved with the C2CUT STO, developing metrics for evaluation is a large, complex challenge. Furthermore, a planned accomplishment for the C2CUT program is “to measure the impact of decision aids on command and control.” Experiments with tactical decision aids, as applied to mixed assets (unattended ground sensor clusters, semiautonomous or autonomous air and ground robots), and the soldier as a system will be conducted. Also, ARL will develop soldier performance models to enhance rapid decision-making with partial and missing information. In FY05, the C2CUT program must evaluate enhanced WEB based decision aids that support soldier centered interactions assisted by software mixed asset management.

### **Proposed Work:**

This work involves the development of metrics for assessing C2 of small units (battalion and below) in urban environments. These metrics will be designed to assess and compare technologies that contribute to C2 in urban environments. These metrics should be designed to allow for measurement and comparison of C2 capabilities based upon data collected from mathematical models, simulated experiments, live experiments, and other data sources. It is envisioned that the efforts of this project may be leveraged by other Army/DoD efforts like the Future Combat System, Future Force Warrior, Horizontal Fusion/Warrior's Edge, and Army Science and Technology projects.

### **Requirements and Milestones:**

- Develop an understanding of the C2 CUT STO and contributing technologies
- Conduct background research on previous C2 CUT related models, simulations, experiments, and analysis efforts
- Perform research to determine the extent to which C2 metrics have been developed for military applications
- Define C2 for urban operations for small units (battalion through squad)
- Construct methodology for development of metrics
- Develop and define metrics for C2 for small unit urban operations

MILESTONE:	DATES:
Stakeholder Interviews	Oct-Nov 04
Background Research on the C2CUT STO and related modeling & analysis efforts	Oct-Nov 04
In-Progress Review (IPR)	Dec 04
Revised and Scoped Problem Statement	Dec-Jan 05
Methodology for development of metrics	Jan-Feb 05
Metric Development	Feb-May 05
In-Progress Review (IPR)	Mar 05
Recommendation and Final Project Briefing	June 05
Technical Report Complete	July 05

### **Project Deliverables and Due Date:**

- IPR: Dec 04
- IPR: March 05
- Final Briefing: June 05
- Technical Report: July 05

**Senior Investigator and Primary Analyst:** LTC Jeffrey B. Schamburg, Ph.D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5539.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator/Principal Analyst:** 1000 Hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Base Camp Analysis: Location, Layout and In-Theatre Infrastructure Assessment 05**

**Research Proposal No.: DSE-R-0536**

### **Client Organization: Construction Engineering Research Laboratories (CERL)**

#### **Points of Contact:**

<b>NAME:</b>	<b>ADDRESS:</b>	<b>PHONE:</b>	<b>OTHER / EMAIL:</b>
Deb Curtin	Engineer Research and Development Center Construction Engineering Research Laboratories 2902 Newmark Dr. Champaign IL 61822	217-398-5567	Deborah.R.Curtin@erdc.usace.army.mil
Stuart Foltz	CFF Engineer Research and Development Center Construction Engineering Research Laboratories PO Box 9005 Champaign, IL 61826	217-373-3487	Stuart.D.Foltz@erdc.usace.army.mil
Richard Marvin Marlatt	Associate Technical Director Facility Acquisition & Revitalization Engineer Research and Development Center PO Box 9005 Champaign, IL 61826	217-373-7290	Richard.M.Marlatt@erdc.usace.army.mil
Kirk McGraw	Research Structural Engineer Engineer Research and Development Center Construction Engineering Research Laboratories PO Box 9005 Champaign, IL 61826		Kirk.D.McGraw@erdc.usace.army.mil

#### **Background:**

The Engineering Management (EM) Program in the Department of Systems Engineering and the Civil Engineering (CE) Program in the Department of Civil and Mechanical Engineering at USMA want to establish a long-term relationship with both the Base Camp Project Delivery Team and the In-Theater Infrastructure Assessment Team at CERL in order to provide research support in the area of Base Camp and In-Theater Assessment studies. These areas of research support the academic objectives of the EM and CE programs at USMA, and provide a forum for both faculty and cadets to apply the concepts from their studies to a real-world military problem. This enhances the academic and professional development of both faculty and cadets as Army officers.

#### **Problem Description:**

The military increasingly needs to plan for, and execute, fast deployments of forces in support of the full continuum of military operations, from combat, peace enforcement, peacekeeping, training and stability and support operations. The Army needs the ability to plan quickly the location, layout and operations of the bases to sustain deployed forces. Planners at the theater level require the doctrinal and technological support necessary to plan, construct, operate and close base camps that are secure, efficient and environmentally sound. Future sustainment areas will be placed throughout the depth of the battlefield to

include deep, close and rear areas. Base camp development in these areas will need to be fast, while fulfilling mission, security and environmental requirements.

A functioning infrastructure not only supports the soldiers winning the war, but the building of the peace afterwards. Accurate infrastructure assessment is required prior to, during and after any conflict to provide support not only to the service members within the theater, but also the citizens caught in the middle of the conflict. Infrastructure includes not only utilities such as power, water, garbage, sewer, but also highways and bridges (WES has lead here) and the buildings supporting or housing the utilities, command and control, and soldiers in the theater. What can the Corps of Engineers do to improve the speed and accuracy of infrastructure assessment?

Presently, there is little guidance, few effective assessment tools and little training associated with infrastructure assessment. Many times the required assessment is beyond in-theater capabilities and/or available assessment tools; therefore, the current solution is to use TeleEngineering to reach-back to the subject matter experts. However, the Requests for Information (RFIs) are many times poorly phrased and contain limited to no essential information needed by the experts to provide a possible solution from a far.

The reoccurring theme through analysis of the support provided for Afghanistan and Iraq is that: (1) remote sensing efforts must be improved to provide initial infrastructure information and triage, (2) assessment tools must be developed for each engineering area of concern to provide in-theater solutions and to guide data collection for reach-back support, (3) training must be conducted with these tools from the FEST down to the individual soldier (especially at Advanced Non-commissioned Officer Courses (ANOC), Engineer Officer Basic Course (EOBC), and Engineer Officer Advanced Course (EOAC), and (4) reach-back assets must be properly supported, staffed, and recognized for the critically important and extremely valuable support they provide when RFIs are correctly worded and contain critical data.

At endstate, the final product should be an integrated product that provides the decision maker with a suite of software tools that determine the location, design, construction, and operation of base camps and identifies key infrastructure and environmental concerns, force protection issues, and specific structural requirements.

#### **Proposed Work:**

The Departments of Systems and Civil and Mechanical Engineering at USMA will continue to assist CERL in determining the requirements for infrastructure assessment and future base camp planning tools. This will be accomplished by hosting a two-day workshop during 2<sup>nd</sup> Quarter of FY05 of key military agencies and personnel who are involved in doctrinal development for, and operational support of, base camp operations and in-theater infrastructure assessment. In coordination with CERL, the Base Camp and Infrastructure Assessment Workshop will be a two-day event with the objective to report on the development of cradle to grave **strategic plans** addressing infrastructure assessment and high priority base camp issues that were discussed in the Base Camp conference held in the Spring of 2004.

Participants will be identified/invited based on coordination with CERL and key agencies in the field. The specific agenda and responsibilities will be defined and coordinated with

CERL. USMA will host the workshop, and produce a proceedings of key presentations and information captured during the workshop for distribution to participants. CERL will have approval authority over release of information.

**Deliverables:**

Base Camp Conference – January/March 2005

- a. *Determine Attendees and Develop and send invitation/notification:* In concert with USACERL develop an invitation workshop to convey succinctly and concisely the objectives and intent of the workshop, participation level, and outcomes expected. Develop a web site for managing registration and distributing information prior and after the workshop.
- b. *Host the Workshop:* Provide meeting space adequate for combined group and breakout groups. Each room should include powerpoint projector, white board, butcher block paper, etc. Provide logistical support (lodging and travel advice) for meeting attendees.
- c. *Determine Workshop format:* In concert with USACERL determine the most optimal conference format to meet expected outcomes. Specifically determine opening guest speakers and individuals who will report on breakout session studies.

**Senior Investigator:** LTC Timothy E. Trainor, Ph.D., USMA – Department of Systems Engineering, 845-938-5534.

**Faculty Analyst:** MAJ John Cushing, M.S., USMA – Department of Systems Engineering, 845-938-4399.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Faculty Analyst:** 40 hours

**Senior Investigator:** 60 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Deployment Analysis and Decision Support, FY05**

**Research Proposal No.: DSE-R-0537**

**Client Organization: Military Surface Deployment and Distribution Command  
(formerly the Military Traffic Management Command (MTMCTEA), Transportation  
Engineering Agency (SDDCTEA)**

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER / EMAIL:
Michael K. Williams	Chief, Deployability Division MTMCTEA 720 Thimble Shoals Blvd. Suite 130 Newport News, VA 23606-2574	757-599-1639 DSN 927-4646	WilliamM@tca-cmh1.army.mil
Bryan Reynolds	Deployability Division MTMCTEA 720 Thimble Shoals Blvd. Suite 130 Newport News, VA 23606-2574	757-599-1619	ReynsB@tca-cmh1.army.mil
Dr. Thom Hodgson	Department of Industrial Engineering Box 7906 North Carolina State University Raleigh, NC 27695	919-515-5194	hodgson@eos.ncsu.edu

### **Problem Description:**

SDDCTEA needs fast, flexible decision support tools to use in the area of deployment planning. They perform extensive sensitivity analysis on the many parameters involved in a military deployment. These include the types of forces deployed, the transportation assets used and the ports through which forces move. Current models lack the flexibility to alter parameters and generate quickly measures of effectiveness for a deployment.

SDDCTEA needs models through which a deployment scenario can be quickly modeled, parameters changed as required and a solution generated.

### **Proposed Work:**

This is a continuation of work from FY04. In FY04, we refined and delivered to the client the Deployment Scheduling Analysis Tool (DSAT). This software decision-support tool allows the user to perform quickly sensitivity analysis for military deployment planning. The software revisions were completed by the computing resources division at USMA. During FY04, we also started a validation and verification efforts of DSAT output against the existing model SDDCTEA uses for deployment planning, the Joint Flow and Analysis System for Transportation (JFAST).

The proposed continued work for FY05 includes:

- Conduct validation and verification testing of DSAT against current models (JFAST) as directed by SDDCTEA and report results to SDDCTEA.
- Training users of DSAT as required.

- Performing database updates as required.
- Support TEA in using DSAT to conduct deployment analyses.

**Requirements and Milestones:**

- Verification/validation testing and analysis reports – as directed by TEA; currently none assigned.

**Deliverables and Timeline:**

None specified by the client as of now. The primary deliverable, the upgraded DSAT software, was provided to SDDCTEA in April 2004.

**Senior Investigators:** LTC Timothy E. Trainor, Ph. D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5534.

**Faculty Analyst:** LTC Barbra Melendez, Ph.D., Assistant Professor, USMA - Dept. of Mathematical Sciences, USMA, 845-938-7436.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 52 Hours (1 hours/week x 52 weeks)

**Faculty Analyst:** 52 Hours (1 hour/week x 52 weeks)

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

**X EQUIPPING – the Force**

**FIGHTING – the Force**

**SUPPORTING – the Force**

## **Homeland Defense Crisis Response Research & Readiness Center**

**Research Project No.: DSE-R-0538**

**Client Organization:** The Armaments Research & Development Center (ARDEC) at Picatinny Arsenal, NJ.

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Thomas McWilliams	TACOM-ARDEC AMSTA-AR-TD Bldg 1, 3rd Floor Picatinny Arsenal, NJ 07806-5000	973-724-2660	tamcwill@pica.army.mil
Dr. Floyd Ribe	Public-Private Partnership Office Bldg 1, Floor 3 AMSTA-AR-WE Picatinny Arsenal, NJ 07806-5000	973-724-6165	fribe@pica.army.mil
Maurice Schall	AMSTA-AR-PSI Director of Security Picatinny Arsenal, NJ 07806-5000		Maurice.schall@us.army.mil
Kenneth P. Yagrich	AMSTA-AR-QAC Director of Human Effects Research Picatinny Arsenal, NJ 07806-5000		Kenneth.yagrich@us.army.mil

### **Problem Description:**

In December 2002, ARDEC entered into a partnership with USMA to gain support for research efforts in the area of Homeland Defense. The principle project involved determining the requirements for a research and training center for Homeland Defense to be built at Picatinny Arsenal. During 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quarters of FY03, USMA formed a multi-disciplinary research team, headed by the ORCEN in the Department of Systems Engineering to do the requirements determination for such a Center. The intent was to design a Center for use by both DOD and civilian emergency response agencies in preparing for Homeland Security/Defense activities. In June 2003, the USMA team turned over a recommended Master Plan for the Center that included:

- The location, sizes and type facilities to be built for this Center situated on the specific terrain identified by Picatinny Arsenal;
- A framework to plan/execute training for users (crawl, walk, run model);
- A list of the specific types of training, and research areas of focus, to execute at the Center based on a needs analysis of potential users;
- An estimate of the cost to construct the Center by facility, and a recommended phasing of the Center development;
- An estimate of the resources required to staff and run the Center;

- A list of issues to be resolved (primarily environmental restrictions of the terrain identified for the Center) in order for the Center to move forward in development.

Federal funding to support the Center development was not provided to implement the Master Plan as detailed above. However, Picatinny Arsenal was designated the New Jersey Center of Excellence for Homeland Security Technologies, Regional Readiness and Training by GOV McGreevey in March 2003. Based on this, ARDEC is active at the state of New Jersey level in planning/organizing Homeland Defense activities for state and local agencies. While creating a federal Center at Picatinny Arsenal may not be possible, ARDEC is working with both the National Guard and several federal, state, and local agencies to provide training and research for Homeland Defense issues. In the past year, ARDEC has implemented portions of the Master Plan as funding has become available. It is currently continuing to seek funding resources to implement the plan as completely as possible.

#### **Proposed Work:**

This is a continuation of the work done during FY03 and FY04. ARDEC is currently working with:

- 1) The National Guard to establish itself as a primary training location for Homeland Defense security training.
- 2) The New Jersey University of Medicine and Dentistry to establish a training facility for medical response to weapons of mass destruction scenarios.
- 3) The United States Postal Service (USPS) to establish a training facility for detection and clearance of weapons of mass destruction from postal facilities.
- 4) Various federal, state, and local law enforcement and emergency medical service agencies to establish a training facility for a wide variety of homeland defense issues.

ARDEC has asked USMA to assist in redefining the Center Master Plan and creating a plan for phased-implementation of that plan as funding/resources become available. This plan will include detailed structural surveys and plans of the proposed facilities to be completed by the Department of Civil and Mechanical Engineering. ARDEC has also requested that the Department of Systems Engineering develop a package of standardized training plans to be used by client organizations at the Center. Finally, ARDEC has asked USMA to aid in the production of a briefing package to aid in the proponency of the Center to prospective clients and governmental officials.

#### **Requirements and Milestones:**

ARDEC is in the initial proposal stages with various agencies. They requested our help, but the full scope of the research will not be clear until they ascertain the extent of their funding.

Estimated D/SE milestones include:

- 1) October 2004: Deliver initial phasing plan with cost estimates.
- 2) December 2004: Complete stakeholder analysis for training plans with the NJ National Guard, University of Medicine and Dentistry, and the USPS.
- 3) March 2005: Deliver draft training plans for security, medical, and postal operations.
- 4) September 2005: Deliver final training plans for security, medical, and postal operations.

**Project Deliverables and Due Date:**

Again, undetermined until the scope is better defined by ARDEC. Likely, the deliverables will include:

- 1) A refined Center Master Plan tailored to their availability of funding and the needs of the organizations contracting to use the Center. Also, a specific deliverable will likely be LTC Trainor's participation on the New Jersey State Working Group for Homeland Defense issues.
- 2) A package of standardized training plans tailored to the training needs of the using agencies/organizations.
- 3) A briefing package to aid in the proponency of the Center to prospective clients and governmental officials.

**Senior Investigator:** LTC Timothy E. Trainor, Ph. D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5534.

**Faculty Analyst(s):** COL Ron Welch, Ph.D., Associate Professor, USMA - Department of Civil and Mechanical Engineering, 845-938-4099, MAJ Robert Lenz, M.S., Instructor, USMA - Department of Systems Engineering, 845-938-4756.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 50 Hours

**Faculty Analyst:** Aggregate estimate for team is 200 Hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**

- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Adaptive Virtual Analytical Test and Research (AVATAR) Environment**

**Research Proposal No.: DSE-R-0541**

**Client Organization:** DARPA

**Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
COL Bill Johnson	DARPA	703-676-0500	wjohnson@darpa.mil

**Problem Description:**

Experience in Iraq, Afghanistan, and other recent Military Operations Other Than War (MOOTW) highlight the need for new tactics, techniques and procedures (TTPs) to combat adversaries who are innovative and adaptive in their tactics. The existing suite of Army simulation environments are not focused on the rapid exploration of emerging TTPs in such a non-traditional environment.

**Proposed Work:**

The Department of Systems Engineering will develop an analytical environment to test prospective TTPs for asymmetric operations in Combined and Joint MOOTW. It will support the tenets of Simulation Based Acquisition (SBA) and Simulation and Modeling for Acquisition, Requirements, and Training (SMART). Specifically, DSE will:

- Develop a full-scale virtual environment in which soldiers can conduct experiments in dynamic situations against adversaries who are live, virtual, constructive, or in any required combination. The term, “avatar,” refers to a synthetic human surrogate in a virtual environment.
- An analytical framework for developing and evaluating alternative solutions to identified acquisition needs.
- A methodology roadmap for designing and testing candidate systems across constructive, virtual, and live simulation domains.

**Requirements and Milestones:**

FY05 is year two of a four-year project that contains three phases. Each builds on and enhances previous phases as well as adds new capability. Further, each phase is developed considering the needs of follow-on phases and is capped by a validation experiment. The project concludes with a capstone experiment exercising all aspects of the combined technology in a distributed constructive, virtual, and live simulation.

**Milestones:**

• Conduct technology needs analysis	Q1 FY04
• Identify existing and emerging technology solutions	Q2 FY04
• Procure selected technology	Q4 FY04
<i>Experiment 1:</i> Technology Integration with Asymmetric Threat Unit Develop framework for analysis in the AVATAR environment Conduct comparative analysis of distributed simulation technologies	Q1 FY05 Q2 FY05 Q2 FY05
<i>Experiment 2:</i> Distributed AVATAR-to-AVATAR Simulation Interim Technical Report and IPR	Q4 FY05 Q4 FY05
• Identify live simulation technology solutions	Q1 FY06
• Procure selected live simulation technology	Q3 FY06
• Initial constructive/virtual/live integration	Q4 FY06
<i>Experiment 3:</i> Constructive/Virtual/Live Asymmetric Threat – Camp Buckner Final Technical Report and Briefing	Q3 FY07 Q4 FY07

**Project Deliverables and Due Date:**

- Interim IPRs: October 2004, March and September 2005 and 2006
- Final Briefing: August 2007
- Technical Report: September 2007

**Senior Investigator:** Dr. Paul West, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5871.

**Faculty Analyst(s):** MAJ Thomas A. Rippert, M.S., Instructor, USMA – Department of Systems Engineering, 845-938-5578.

**Supporting Laboratory Technician:** IT services to be acquired by contract

**Resources Required for Project:****Research Hours Required (by position):**

**Senior Investigator:** 480 hours (3 man-months) in FY05

**Principal Analyst:** 160 hours

**Lab Technician:** 960 hours (FY05)

**Lab Use Hours:** 1000 hours, AMSD

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **PART X - AY05 Capstone Research Program**

## **Bandwidth Allocation Study for the Disposable, Air-droppable, Meteorological Tower Array (DAMTA)**

**Capstone Research Project No.: DSE-CR-0501**

**Client Organization:** Army Research Lab (ARL), Computational and Information Sciences Directorate, Battlefield Environment Division, at White Sands Missile Range (WSMR), New Mexico.

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Ed Creegan, ARL, WSMR	17445 Tierra Alta Rd. Las Cruces, NM 88011	Ofc 505-678-4684 Cell 505-649-4293	ecreegan@arl.army.mil
Mr. Bud Dagle, Applied Tech Inc.	1120 Delaware Ave. Longmont, CO 80501	Ofc 303-684-8722 Fax 303-684-8773	bud@apptech.com

### **Background:**

Weather and other environmental data are critical information that affects the decision-making abilities of commanders on the battlefield. Disposable, Air-droppable, Meteorological Tower Array (DAMTA) consists of a sensor-based platform that will be dispersed over an area of interest and provide key weather data (e.g., temperature, wind speed, pressure, and humidity) and images to enhance the accuracy of the current Army Forecast Models, provide information on remote areas of the battlefield, provide forecasting for future battlefield operations and gather additional information about out of sector areas. In 2002, the USMA research explored the alternatives that would deliver DAMTA to the battlefield. The 2002 research team recommended the deliverable system (parachute), the configuration of the system and the means (i.e., helicopter) to drop DAMTA to the desired location. In 2003, the research explored the benefits of imagery and the integration of an imagery device on the DAMTA platform. The 2003 research team recommended a miniature camera; identified the imagery configuration for the DAMTA platform and research the role (value) imagery plays for users of the system.

### **Problem Description:**

DAMTA gathers several different data items including imagery for users. ARL/WSMR wants the Department of Systems Engineering (DSE), USMA to develop and examine the best alternative to delivery the data items specifically imagery to users on the battlefield considering the constraints of cost, time (time to receive real time images) and bandwidth. ARL/WSMR also wants DSE to study the bandwidth aspects of the DAMTA network considering the DAMTA must be self-sustaining for at least 30 days with its inherent battery supply. ATI develops core part of DAMTA effort that camera will integrate with.

**Proposed Work:**

1. Examine the needs of the stakeholders including the constraints of the problems to include: 1) communication capabilities and size, 2) DAMTA size and weight and 3) image resolution and size (list is not inclusive).
2. Develop a model and flow chart for the current DAMTA network including the current size and capability of the bandwidth between entities.
3. Develop a Value Hierarchy which represents the trade-offs associated with transferring data (i.e., images) from the DAMTA terminal.
4. Examine current radio and bandwidth technologies within the military's current sensor arsenal.
5. Examine DAMTA's role on the sensor battlefield and within Future Combat Force structure.
6. Develop several different alternatives (at least 30 alternatives) to transmitting data (specifically images) from the DAMTA sensor array (terminal) to the user on the adhoc network. Alternatives are in detail and should be represented in a 2D model or other type of model.
7. Model and test alternatives based on the trade-offs identified in the Value System Design.
8. Complete cost analysis modeling of the value and cost of each alternative.
9. Make a recommendation on "How to best transfer images from the DAMTA to the user?"
10. Develop a schematic or detailed list of resources needed to implement the recommended alternative (e.g., power, and computer resources; size requirements).

**Requirements and Milestones:**

- Project Orientation – August/September 2004
- Apply Systems Engineering Management Process – August 2004 thru May 2005
- Develop Initial Engineering Project Management Plan – September 2004
- Conduct Interim Progress Review – December 2004
- Turn in Interim Project Report – December 2004

**Project Deliverables:**

1. All items relevant within the Systems Engineering and Management Process.
2. All proposed work items (above paragraph).

**Senior Investigator:** LTC Robert A. Powell, Ph. D., Assistant Professor, USMA - Department of Systems Engineering, 845-938-4311.

**Number of Cadets:** Interdisciplinary Team: Up to 5 CDTs (1-EECS, 1 SE, 3 EM) Project requires a Signal Officer or EE&CS faculty to assist in testing the alternatives and modeling the specific DAMTA network strategies.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 50 Hours

**Total Cadet Time:** 200 Hours

**Lab Use Hours:** The DAMTA room will be used extensively. Other labs (i.e., CSL or SMDL) will be used if simulation is needed.

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Performing Verification and Validation Measures in Prioritizing Construction of Base Camp Facilities and Infrastructure**

**Capstone Research Project No.: DSE-CR-0502**

**Client Organization: Construction Engineering Research Laboratories (CERL)**

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER / EMAIL:
Kirk McGraw	Director Engineer Research and Development Center Construction Engineering Research Laboratories ATTN: CEERD-CF-F (Kirk McGraw) P.O. Box 9005 Champaign, ILL 61826-9005	Ofc (217) 373-3328 Cell (217) 353-1320 Fax (217) 373-3490	Kirk.D.McGraw@erdc.usace.army.mil
MAJ Sam Hunter (USAR)	Research Civil Engineer Engineer Research and Development Center Construction Engineering Research Laboratories ATTN: CEERD-CF-F (Sam Hunter) P.O. Box 9005 Champaign, ILL 61826-9005	Ofc (217) 373-4470 Fax (217) 373-3490	Samuel.L.Hunter@erdc.usace.army.mil

### **Problem Description:**

The military increasingly needs to plan for, and execute, fast deployments of forces in support of the full continuum of military operations, from combat, peace enforcement, peacekeeping, training and stability and support operations. The Army needs the ability to plan quickly the location, layout and operations of the bases to sustain deployed forces. Planners at the theater level require the doctrinal and technological support necessary to plan, construct, operate and close base camps that are secure, efficient and environmentally sound. Future sustainment areas will be placed throughout the depth of the battlefield to include deep, close and rear areas. Base camp development in these areas will need to be fast, while fulfilling mission, security and environmental requirements.

There is currently no doctrine for the construction and dismantling of base camps; however the **Engineering Management (EM) Program in the Department of Systems Engineering** has begun base camp research in the area of prioritization of construction efforts, which is intended to contribute to military doctrine. Continuing research is required in the verification and validation of prioritization of construction efforts for base camp infrastructure and facilities. These efforts include a comprehensive review of base camp facilities and a comprehensive review of base camp factors and variables (e.g., environmental issues) and their impact on construction of base camp facilities. At end state, the final product should be an integrated product that provides the decision maker with a software tool that aids in the location, design, construction, and operation of base camps considering key infrastructure and environmental concerns, force protection issues, and specific structural requirements.

These areas of research support the academic objectives of the EM program at USMA, and provide a forum for both faculty and cadets to apply the concepts from their studies to a

real-world military problem. This enhances the academic and professional development of both faculty and cadets as Army officers.

### **Proposed Work:**

The Department of Systems Engineering at USMA will assist CERL in identifying construction prioritization factors to satisfy the needs of field commanders responsible for base camp operations. This project will be accomplished during Academic Year 2005 by a multi-disciplinary team of four individuals – an Operations Research major; a Systems Engineering major, and two Engineering Management majors.

Work to support this effort will involve requirements Analysis, both Operations and Mission Specific, and determination of the data requirements for a software decision-support tools for higher commanders and operational planners.

The team will apply the Systems Engineering Management Process to the specific base camp planning issue, incorporating research of existing doctrine and tools, outcomes of the base camp workshop, coordination with from experts, and past research performed in this area; and apply appropriate tools to derive a solution useful to the client. The final product will be a tool that aids the decision maker in prioritizing base camp construction tasks.

### **Requirements and Milestones:**

- Project Orientation at USMA – August/September 2004
- Systems Engineering Management Process – August 2004 thru May 2005
- Initial Engineering Project Management Plan – September 2004
- MPC Panama Data Collection, Fort Sam Houston, TX – 20-23 September 2004
- Interim Progress Review – December 2004
- FPC Panama Data Collection, Panama City, Panama – 30 November – 4 December, 2004
- Client Decision Brief – April 2005
- Final Project Brief – May 2005
- Final Project Report – May 2005
- New Horizon '05 Panama – 15 Feb thru 15 May 2005

**Deliverables:**

- 1) A list of key parameters that affect the sequencing of base camp construction tasks. As a starting point, the team should validate and verify the list developed under the 2004 Capstone project.
- 2) A list of key construction types found at base camps. Again, the existing list should be validated and verified with domain experts.
- 3) A methodology for prioritizing the sequence of construction tasks for Combat, Support, Humanitarian and Peacekeeping missions. For each of these situations, given an assessment (high, medium, low) of the parameters in list (1), rank the types in list (2) according to construction start date. The methodology developed in 2004 provides results that are consistent with CERL's experience. However, it is believed that pair wise comparison prevents the lowest ranked parameter from being correctly evaluated (multiplication by zero always yields zero).
- 4) A decision support tool for use by operational planners. The preferred delivery mechanism for (3) is an interactive web site, although Microsoft Excel or other mainstream platforms are acceptable alternatives. Testing of the 2004 Capstone product indicates including mission type as an input parameter and restricting the output to a single ranked list could reduce confusion. Further, it is recommended that the survey instrument for (1), (2) and (3) be part of the web site to maximize the number of responses.
- 5) Final Report describing the research.

**Senior Investigator:** LTC Robert A. Powell, Ph.D., Assistant Professor, USMA –  
Department of Systems Engineering, 845-938-4311.

**Number of Cadets Involved:** Four (4).

**Resources Required for Project:** N/A

**Research Hours Required (by position):** N/A

**Senior Investigator-** 50 Hours

**Total Cadet Time:** 2 Semesters for 4 cadets in AY05

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

**EQUIPPING – the Force**

**X FIGHTING – the Force**

SUPPORTING – the Force

# **A Study of Existing Technologies for Identifying and Assessing Urban Infrastructure/Infrastructure Recon for Urban Operations**

**Capstone Research Proposal No.: DSE-CR-0503**

**Client Organization:** Construction Engineering Research Laboratories (CERL)

## **Points of Contact:**

<b>NAME:</b>	<b>ADDRESS:</b>	<b>PHONE:</b>	<b>OTHER / EMAIL:</b>
Mr. Mark Ginsberg	Engineer Research and Development Center Construction Engineering Research Laboratories P.O. Box 9005 Champaign, ILL 61826-9005	Ofc 217-373-6754 Fax 217-373-7222	Mark.D.Ginsberg@erdc.usacc.army.mil
Dr. Charles Marsh	Engineer Research and Development Center Construction Engineering Research Laboratories P.O. Box 9005 Champaign, ILL 61826-9005	Fax 217-373-7222	Charles.P.Marsh@erdc.usacc.army.mil

## **Problem Description:**

In major operations since World War II, the United States military has preferred to bypass major urban areas to avoid the type of high intensity, close combat expected there. The explosive growth of the world's major urban centers, changes in enemy strategies, and the Global War on Terrorism, however, have made the urban battlespace increasingly decisive and virtually unavoidable.

The urban environment blunts many of the advantages that US forces enjoy in more open terrain. It strips away our ability to see farther and more clearly, maneuver faster, and engage more precisely than the enemy. Our challenge is to develop new levels of urban military capability not only to win in the urban battlespace, but also to convincingly deter our enemies from even considering fighting in urban terrain.

Given the complexity and challenges of operating in an urban environment, the central theme for joint urban operations is: achieving our desired end state by understanding, controlling, and exploiting the unique elements of the urban environment (e.g., terrain, infrastructure, population, and information); sensing, locating, isolating, and destroying the adversary; controlling the pace and tempo of operations; and applying power precisely and discriminately. Power includes the coherent application of sequential and simultaneous, military and nonmilitary, kinetic and nonkinetic means to achieve lethal and nonlethal effects.

Success in joint urban operations requires several conditions. First, it requires a holistic understanding of the complexity of the urban environment, including the enemy, friendly forces and the people, systems, and infrastructure that comprise the modern city. Second, success requires deliberate efforts to shape information and operational environments to set the right conditions for rapid and precise action. Third, distributed effects-based operations require as current and precise knowledge as is possible and focused precision capabilities to

destroy or capture critical nodes which underpin the coherence of the enemy force. By continuously consolidating our gains, we are able to apply increasing pressure on the enemy.

Eight principles guide the planning, preparation, deployment, employment, and sustainment for urban operations:

1. Understand the complex urban environment.
2. See first, see clearly, and see in depth.
3. Control the urban environment.
4. Isolate the adversary.
5. Take the initiative and control the tempo of operations.
6. Engage the adversary comprehensively.
7. Ensure every action contributes to achieving the desired end state.
8. Balance restraint and overmatching power.

Operations in the urban environment can no longer be considered an “elective” competency of the joint force. Our adversaries have already recognized the potential of using the urban battlespace to mitigate our overwhelming military advantages. The US must move quickly and aggressively to develop the capabilities necessary to establish dominance in this environment as we have in others, deter the enemy from operating there, and defeat him decisively when deterrence fails.

In particular, the proposed work focuses on development of reconnaissance capability in the urban environment. (See bolded points on the bullet list above.) The objective is to collect information regarding several centers of expertise within the Army that have, heretofore, not been required to work together as a group. These centers include: the structural research, the sensors and reconnaissance, and the front-line warfighter.

These areas of research support the academic objectives of the EM program at USMA, and provide a forum for both faculty and cadets to apply the concepts from their studies to a real-world military problem. This enhances the academic and professional development of both faculty and cadets as Army officers.

### **Proposed Work:**

The Department of Systems Engineering at USMA will assist ERDC-CERL in two phases.

First, assist in gathering materials describing pre-existing resources and organizations that ERDC will have to cooperate with to either obtain existing data or field new capabilities. Important points to be tracked down include:

- What resources are currently available?
- What forms of information would be most helpful to the warfighter?
- How can the existing resources be best exploited to fill these needs?

Second, during the process of gathering materials for phase I, propose a strategy(ies) to develop a new application(s) in this area using pre-existing data resources. If it is found that current resources are sufficient to develop one or more new applications, pick one and develop this through the proof-of-concept stage. If it is found that current data resources are insufficient, develop a strategy for a new application that maximizes use of existing reconnaissance resources with minimal new capabilities.

The proposed project has a rather loose specification, but the topic area is relatively new and participants can be assured that a creditable performance will lead to long-term research and development efforts carried out by ERDC for many years.

This project will be accomplished during Academic Year 2005 by a multi-disciplinary team of four individuals – an Operations Research major; a Systems Engineering major, and two Engineering Management majors with a minor in civil engineering and nuclear engineering, respectively.

**Requirements and Milestones:**

- Project Orientation – September 2004
- Apply Systems Engineering Management Process – August 2004 thru May 2005
- Draft Initial Engineering Project Management Plan – September 2004
- Conduct Interim Progress Review – December 2004
- Conduct Client Decision Brief – April 2005
- Present Final Project Brief – May 2005
- Turn in Final Project Report – May 2005

**Deliverables:** Primary deliverables would be:

- 3<sup>rd</sup> quarter FY05 – Report on findings of phase 1.
- 4<sup>th</sup> quarter FY05 – Proof of concept demonstration of phase 2.
- 4<sup>th</sup> quarter FY05 – Report summarizing proof of concept demonstration.

**Senior Investigator:** LTC Robert A. Powell, Ph.D., Assistant Professor, USMA - Department of Systems Engineering, 845-938-4311.

**Number of Cadets Involved:** Four (4).

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 100 Hours

**Total Cadet Time:** 240 Hours (x4 cadets)

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# Feasibility Study on Automating Rules of Engagement in Fully Automated Target Engagement Systems

Capstone Research Proposal No.: DSE-CR-0504

**Client Organization:** TBD

## Problem Description:

Since the beginning stages of US Force transformation, systems and force designers have long recognized both the need and the complexity of incorporating specific rules of engagement into the process of identifying, classifying and engaging hostile targets on the battlefield. As recent as Operation Iraqi Freedom, the accepted practice for commanders to be assured such criteria are met prior to target engagement with weapons systems (including insuring that such targets are not friendly forces) is to require an appropriate Staff Judge Advocate representative in the target engagement loop. The difficulty with proceeding in this fashion as the US Army undergoes force transformation in the years to come is that past experience in Kosovo, Afghanistan and Iraq suggest that these SJA human points might severely degrade the speed at which targets of opportunity are engaged, possibly enabling such targets to escape engagement altogether. This is especially a problem for intelligence targets whose engagement window is narrow to begin with.

In the context of Network Centric Operations for U.S. Army forces , not automating such a practice has the potential to significantly hamper or impede several key influence relationships that have been identified as critical to the success of NCO on the battlefield. Thus, this issue is clearly a command and control concern. Figure 1 illustrates the most recent theory on such influence relationships, which was jointly developed by Rand and Evidence Based Research, Inc. in collaboration with the Office of Force Transformation, Office of the Secretary of Defense.

*Command and Control of a Networked Force*

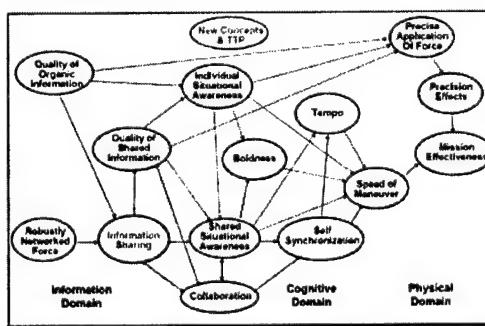


Figure 1. NCO Effects Influence Diagram.<sup>1</sup>

One possible solution to this dilemma is to imbed the rules of engagement into the system itself, thereby relegating the process to automation and removing the human from the target engagement loop.

**Proposed Work:**

There are a host of issues associated with automating the test of meeting rules of engagement within a targeting engagement loop, some practical, some legal, and some system-based. Within this work, we intend to investigate the following:

- Study Question 1. Who are the stakeholders in such a proposed system and what concerns do they have that must be addressed prior to acceptance and deployment?
- Study Question 2. Is such an approach feasible in selected systems available to U.S. ground forces today? If so, then what such systems are amenable to accepting this type of automated process?
- Study Question 3. If not, then what factors are impeding feasibility and how can these be overcome? (e.g., social, legal, operational, technological, etc.)
- Study Question 4. What impact would automated ROE have on current force operations?
- Study Question 5. What impact does the goal of automating ROE have on the practices taught at the SJA schools?
- Study Question 6. Is it necessary to modify the ways ROE are specified in order to accommodate automation?
- Study Question 7. What impact does the current practice have on various key influence relationships underlying current tenets of Network Centric Operations and the conceptual framework (NCOCF)?
- Study Question 8. What type of architecture exists that could accept and apply ROE within an automated targeting framework?
- Study Question 9. Does automating ROE necessarily dictate using a logical network learning system? (e.g., Bayesian Networks, Fuzzy Logic, Dempster-Shafer, Probabilistic Modal Logic, etc.)

**Requirements and Milestones: TBD****Deliverables:**

- Final report in May 2005.
- Presentation at Capstone Day, USMA, May 2005.
- Presentation at MORS Symposium, June 2005.

**Timelines:**

- Sep – Dec 2004 -** Conduct extensive stakeholder analysis, identify significant system-level functions and major issues/barriers, develop a network

representation of current NCO ROE systems, identify criteria under which automating ROE is possible.

**Jan – March 2005 -** Develop prototype to demonstrate a systems ability to automate ROE.

**April – May 2005 -** Complete final report write up, preparation for presentations.

**Principal Investigator:** Dr. Patrick J. Driscoll, Ph.D., Professor of Operations Research, USMA - Department of Systems Engineering, 845-938-6587.

**Co-principal Investigator:** Dr. Mark Welton, JJD, Ph.D., Professor of Law, USMA - Department of Law, 845-938-5115.

**Number of Cadets/Number of Design Teams Involved:** 4 cadets, 1 design team

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigators:** 60 hours each

**Total Cadet Time:** 300 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# Systems Modeling & Analysis of Retread Supply Chain Operations

Capstone Research Proposal No.: DSE-CR-0505

**Client Organization:** Tirecenters, Inc. & TACOM Tire Group

## Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Roy Bromfield, CEO	310 Inglesby Parkway	800-603-2430	Roy.bromfield@tirecenters.com
Mr. Harold "Butch" Jordan Director of Supply Chain Opr.			Butch.jordan@tirecenters.com website: www.tirecenters.com
Mr. Anthony Warrior Acting Chief, Tire Group US Army TACOM	US Army TACOM	586-574-4294	Anthony.a.warrior@us.army.mil
Mr. Glen Gula		DSN: 786-4259	
Mr. Brian McCutchen		DSN: 786-4294	
Ms. Bonnie Marx		DSN: 786-4271	

## Problem Description:

Tirecenters, LLC is a wholly owned subsidiary of Michelin, North America. Its function is company-owned distribution of tire products. It is one distribution channel for Michelin to get its product to the market. There are three major divisions in Tirecenters. One division is called Commercial Operations, which represents about \$420 million worth of business. It sells and distributes commercial truck tires, off-the-road tires such as those used on bulldozers and heavy construction equipment, and industrial tires. The second division is called the Small Tire Distribution Division. It represents about \$250 million in annual business revenue for Tirecenters. The Small Tire Distribution Division is a pure distributing wholesaler of passenger and light truck tires to small independent retail tire stores. Typically, these stores are not big enough to merit a direct relationship with Michelin. The 3rd division of Tirecenters is the Manufacturing division, which manufactures commercial tires as retreads. It has no sales component.

In terms of sales, the Commercial and Small Tire Distribution divisions each have two types of customers: national accounts and local businesses. National accounts are customer accounts that have a direct financial arrangement with Michelin (such as delivering OEM parts to car factories). The tires sent to national accounts are delivered by Tirecenters on Michelin's behalf, for which Tirecenters charges a fee. The local business customers rely on a Tirecenters sales force to sell tires to local retail.

In terms of manufacturing, the inner steel support of commercial truck tires, called casings, are designed to last several hundred thousand miles. Each non-damaged casing is engineered so that it is expected to be able to be retread 3 or 4 times before being discarded. This means that the casings represent an asset with value to any truck company that owns a commercial tire. On an annual basis, Tirecenters retreads customer casings on

national accounts as a mainstay of their manufacturing operation. These casings come from national truck fleets such as Yellow Trucking, and number in the millions. Tirecenters charges both a delivery commission plus labor and materials for retreading tires. These national accounts generate about \$750K in annual revenue for Tirecenters. However, as part of an overall tire product line, Tirecenters also sells retread casings that they own and maintain in inventory. Tirecenters acquires these casings over time because they are often traded in on new commercial tires and, if suitable, will get shipped to one of Tirecenters 13 retread facilities, a new tread applied, and then sold. This part of the business represents about \$250K in annual revenue. Retread tires are one of the price tiers in the Michelin product line (MRT: the value line) because there is a substantial market for them, typically in support of local city deliveries that chew up tires on trucks. The cost to such an operation is about half the price of a normal commercial tire. They also are a great trailer tire.

Not every tire makes it to retreading. Tirecenters often has to take casings or refinished product and inject it into the market to compensate for destroyed inventory in national accounts. The challenge is that they must have sufficient high grade casings available for the retread operation at each of the 13 retread centers it operates around the country.

Tirecenters is the largest retread business in the US, representing about 7% of the nations market. There is no supplier of commercial casings that matches up with them on any scale. Thus, the casing acquisition market (supply to their operation) is highly fragmented, consisting mainly of small, highly disbursed sources. In May-Sep, all of the 13 retread operation centers are fully occupied working on national account tires. This essentially ceases in October. From Nov – Feb there is no demand for national account work for a variety of reasons. During this lull, Tirecenters typically shifts the focus of the retread operations to working on replenishing Tirecenters' inventory of commercial tires. Because the many suppliers know that this high demand for their casings is coming, they exploit this selling opportunity by increasing casing prices substantially.

Tirecenters is looking for ways to overcome this vulnerable position by understanding the overall casing and retread operation as a system. As the primary retread operation in the US, they are convinced that they should be able to either shape the supply market in their favor or modify their operational practices in some way that diffuses the pricing disadvantage they experience. Either option, or any other for that matter, requires that they better understand the impact of buying casings throughout the year, the impact of various inventory setting strategies that keep them from surging to meet their own manufacturing requirements, how offshore sources might be able to alleviate this situation, what options do they have to re-represent their supply chain business model (i.e., reshape their business activity to spread their demand for retread tires throughout the year), at what cost?

The issues raised by the client directly fall in the domain of supply chain management, a global concern of all logistic systems to include those used by the U.S. Army TACOM independent of whether purchasing of resources from suppliers is directly addressed or not. Recently, TACOM has instituted a program of producing and supplying complete tire assemblies, a process imbedded in the overall supply chain being studied. Moreover, the results of this study should illuminate several important elements related to how Network Centric Logistics should be implemented to complement Force Transformation.

**Requirements and Milestones:** TBD

**Deliverables:**

- Client IPRs: December, February
- Final report May 2005
- Presentation at USMA-DSE Capstone Day May 2005
- Presentation at MORS Symposium June 2005

**Timelines:**

- Sep – Dec 2004 -** Conduct extensive stakeholder analysis, identify significant system-level functions and major issues, develop network representation of supply chain, develop refined problem statement focusing on major underlying causes of client system difficulty, propose alternative analysis options.
- Jan – March 2005 -** Perform appropriate systems analysis of alternative solutions.
- April – May 2005 -** Complete final report write up, preparation for presentations.

**Principal Investigator:** Dr. Patrick J. Driscoll, Ph.D., Professor of Operations Research,  
USMA - Department of Systems Engineering, 845-938-6587.

**Number of Cadets/Number of Design Teams Involved:** 4 cadets, 1 design team

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigators:** 60 hours each

**Total Cadet Time:** 300 hours

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

**X EQUIPPING – the Force**

**FIGHTING – the Force**

**X SUPPORTING – the Force**

## **Communications Model Analysis**

**Capstone Research Proposal No.: DSE-CR-0506**

**Client Organization:** Space and Terrestrial Communications Directorate, CERDEC-RDECOM, Ft. Monmouth, NJ 07703

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Robert Both	Director, Space and Terrestrial Communications Directorate Communications-Electronics Research, Development, and Engineering Center (CERDEC) Research, Development, and Engineering Command (RDECOM) Ft. Monmouth, NJ 07703	732-427-6203	bob.both@us.army.mil

### **Problem Description:**

The Space and Terrestrial Communications Technology Directorate (S&TCD) of the Communications-Electronics Research, Development, and Engineering Center (CERDEC) of the Research, Development, and Engineering Command (RDECOM) has the mission to acquire, develop and integrate secure seamless tactical communications for the digitized battlefield. S&TCD performs research, development, and engineering functions in all aspects of terrestrial, avionics, and space-dependent communications technology.

One of the tools used by S&TCD is the Comsim Sensor Network Simulator/ Analysis Tool. Comsim uses a complex radio propagation model, called knife-edge, to determine the probability of two sites communicating with each other. Comsim takes into account the effects of terrain elevation and ground cover on communications ranges and sensor coverage. To create the proper model, a seamless world database was assembled from many sources. The simulation model computes the Path Loss Capability (PLC) and compares it to the total attenuation over the path between the transmitter and the receiver. PLC must be greater than total attenuation for successful communication. Each parameter used to compute PLC and total attenuation can be changed in an attempt to optimize their values for some particular cost-benefit function.

In order to better understand the relationship between the Comsim parameters and sensor network performance (i.e., communication ranges and sensor coverage), S&TCD has asked our research team to conduct an analysis of the various input parameters used in the Comsim model. They are especially interested in any operational insights we might discover.

### **Proposed Work:**

- Investigate the problem area and develop a study plan.

- Conduct a literature review to better understand the Comsim model, communications processes, and sensor/communication simulators. Become proficient in operating the Comsim model.
- Interview S&TCD personnel to identify and prioritize the parameters for investigation.
- Execute sufficient simulation model runs to collect adequate data for a valid analysis of each parameter being investigated.
- Analyze the data to identify the “best” value for each parameter under investigation and to identify insights into relationships between the parameter and sensor network performance.
- Conduct a sensitivity analysis to assess the sensitivity of the model simulations to changes in terrain and operational situations.
- Prepare a written technical report with an executive summary and documentation of the design team effort (endnotes and bibliography).

**Requirements and Milestones:**

- Initial site visit: 3 Sep 04
- Next site visit: 4 Oct 04
- Subsequent site visits: TBD

**Project Deliverables and Due Dates:**

- IPR: 9 Dec 04
- IPR: 25 Feb 05
- Final Briefing: 4 May 05
- MORSS Presentation: Jun 05
- Technical Report: Jun 05

**Senior Investigator:** LTC William S. Bland, Ph.D., Assistant Professor, USMA – Department of Systems Engineering 845-938-8115.

**Number of Cadets/Number of Design Teams Involved:** A cadet design team consisting of one Information Systems Engineering major, one Systems Engineering major, one Operations Research major, and two Engineering Management majors.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator/Principal Analyst:** 160 hours (4 hrs/wk for 2 semesters)

**Total Cadet Time:** 600 hours (5 cadets for 2 semesters)

**Lab Use Hours:** 80 hours (simulation runs and analysis)

**Laboratory Technician Hours:** 4 hours (Installation of Comsim model)

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Integration of Systems Engineering Best Practices with DoD Acquisition Policy**

**Capstone Research Proposal No.: DSE-CR-0507**

**Client Organization:** Office of the Under Secretary of Defense

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Dr. Glenn F. Lamartin	Office of the Under Secretary of Defense, Director of Defense Systems		
Mr. Mark Schaeffer	Principle to the Assistant Secretary for Acquisition (OUSD (AT&L))		
Mr. Merrill Yee	OUSD(AT&L)DS/SE	(703) 695-2300	merrill.yee@osd.mil

## **Problem Description:**

According to Dr. Glenn F. Lamartin, Office of the Under Secretary of Defense, Director of Defense Systems, the purpose of the Systems Engineering (SE) Forum is to “drive good systems engineering back into the way we do business.” That is, to integrate best practices of systems engineering into the defense acquisition process.

## **Proposed Work:**

The purpose of the SE Forum, established at the direction of Secretary Wynne, is to examine a set of critical questions:

- What is good systems engineering?
- How to plan for good systems engineering best practices?
- What tools are useful and what needs to be developed?
- How do we educate the SE workforce?
- What can we learn from each other?
- How are service (component) programs doing SE?
- How do we accomplished SE in a System of Systems environment?

## **Requirements and Milestones:**

- Publish Systems Engineering Acquisition Policy (E10) for inclusion into DODI 5000.2.

- Publish implementation guidance for SE strategy, planning, processes, SE application to acquisition phases, design considerations, and technical reviews is provided in the Systems Engineering chapter of the Defense Acquisition Guidebook.
- Policy will include: E10.2 Systems Engineering Leadership; E10.3 Systems Engineering Strategy; E10.4. Systems Engineering Planning; and E10.5. Technical Reviews.

**Project Deliverables and Due Date:**

- Specific milestones for project deliverables TBD by OSD AL&T.
- Interim Report Due Date: December 2004.
- Technical Report Due Date: May 2005.

**Senior Investigator:** COL Mike L. McGinnis, Ph. D., Professor & Head, USMA – Department of Systems Engineering, (845) 938-2701.

**Faculty Analyst(s):** Dr. Niki Goerger, Assistant Professor (845) 938-3180; MAJ Robert Keeter, M. S., Instructor, USMA – Department of Systems Engineering, (845) 938-4857.

**Number of Cadets/Number of Design Teams Involved:** Cadet Design Team consisting of CDTs J. Forman, A. Hitchings, T. Reinold, E. Turner, M. Vrabel.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 200 hours

**Principal Analyst:** 100 hours x 2 = 200 hours

**Total Cadet Time:** 160 hours per cadet x 5 cadets = 800 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Simulation Studies to Support USMA R-Day Design**

**Capstone Research Proposal No.: DSE-CR-0508**

**Client Organization: USMA-USCC**

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
CDT Jeff Glick	USCC, CO D2	845-515-1561	x50593@usma.edu
CDT Steve Fuller	USCC, CO B2	845-515-3903	x59742@usma.edu
CDT Tom Kavanaugh	USCC, CO C3	845-515-3662	x58348@usma.edu
CDT Arlan Sheets	USCC, CO B4	845-515-4262	x57315@usma.edu

### **Problem Description:**

The current R-Day operations, particularly events from the time New Cadets arrive at Thayer Hall until the Oath Ceremony at Trophy Point, are not functioning at optimal rates. Specifically, there are areas of Thayer Hall and the Cadet Area USCC would like analyzed to see if back-ups of candidates in Thayer Hall can be alleviated and the process in the Cadet Area streamlined to ensure each candidate is properly measured for and fitted with ME trousers for the Oath Ceremony.

Proposed Work: Model Thayer Hall and Cadet Areas of the R-Day process to analyze the results with the desire of eliminating the inefficient build-up of candidates, which results in some candidates not being properly trained and properly attired for the Oath Ceremony. Specifically, we will look at the Oath Station flow, the effect of introducing a haircut inspection station in Thayer Hall, and switching the order and location of Stations 4 and 5. Additionally, we will analyze methods for improving the flow of candidates to lunch, Cadet Area issue points, and the barbershop with the same goal. We will also look at the size of training groups and duration of drill and ceremony stations in order to make the Cadet Area activities more efficient.

### **Requirements and Milestones:**

- Problem Definition Complete – 22 September 2004
- Design and Analysis Complete – 23 November 2004
- Decision Making Complete – February 2005
- Implementation Complete – April 2005

**Project Deliverables and Due Date:**

- IPR #1 - 24 September 2004
- IPR #2 - 29 October 2004
- IPR #3 - 1 December 2004
- IPR #4 - 25/26 January 2005
- IPR #5 - 02/03 March 2005
- IPR #6 - 30/31 March 2005
- Final Briefing - 9 December 2004
- Technical Report - 9 December 2004

**Senior Investigator:** LTC Simon Goerger, Ph. D., Instructor, USMA – Department of Systems Engineering, (845) 938-5535.

**Faculty Analyst(s):** MAJ John Harris, M. S., Instructor, USMA – Department of Systems Engineering, (845) 938-5536.

**Number of Cadets/Number of Design Teams Involved:** Four cadets enrolled in SE402/403 and four to eight teams of cadets modeling, validating, and analyzing portions of the R-Day process in SE481.

**Supporting Laboratory Technician:** John Melendez for the installation and management of ProModel and Logical Decisions licenses on SE lab systems.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 30 Hours

**Principal Analyst:** 15 Hours

**Lab Technician:** 5 Hours

**Total Cadet Time:** 60 Hours per Cadet

**Lab Use Hours:** 100 Hours in any lab with ProModel

**Laboratory Technician Hours:** 5 Hours

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**X MANNING – the Force**

**X TRAINING – the Force**

**X EQUIPPING – the Force**

- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Simulation Analysis Studies to Support PEO Soldier**

**Capstone Research Proposal No.: DSE-CR-0509**

**Client Organization: PEO Soldier System**

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
David Schimmel	US Army PEO Soldier – PM Soldier Warrior Technincal Management Division (PM-SWAR TMD) 10125 Kingman Road, Bldg 317 Fort Belvior, VA 22060-5820	703-704-1907 DSN 654	
Mark Holder Vice President.	Vitronics Inc 3 Corbett Way Eatontown, NJ 07724-2283	732-389-0244	

### **Problem Description:**

The United States Army is continuing research on the PEO Soldier system for the American soldier, particularly scientists are looking in the area of power optimization. Utilizing the PEO Soldier system, American soldiers are given the capabilities of using personal protection body armor, lighter-weight helmets and the commander's digital assistant, which provides situational awareness and mission planning capabilities. However the soldiers who wear this system are tasked to perform various missions. With an already heavy load the American soldier will also be weighed down by this system so adding extra weight with batteries will only decrease a soldiers capabilities. The PEO Soldier system has to be reliable on the battlefield, but needs to be feasible in terms of weight. Our capstone team is tasked to look at how the PEO Soldier System can be effective without adding any additional weight to the system. The purpose of this analysis is to provide PEO Soldier with an update of the simulated power usage with the addition of batteries as a part of the system and how the battery requirement can be met within a weight constraint. A military scenario will test whether the Battery capacity and discharge characteristics support the mission implied by the situation.

### **Proposed Work:**

The cadets working on this Capstone Project will interview clients, create simulations and collect data from those simulations, create realistic military scenarios where the PEO Soldier System could be implemented, and report solutions to our points of contact.

### **Requirements and Milestones:**

- Cadets will report progress to the clients monthly.

- Cadets will provide an IPR and an interim report to the client at the end of the first semester.
- Cadets will deliver a final report and completed simulation at the end of the second semester.

**Senior Investigator:** Dr. Bobbie L. Foote, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893.

**Faculty Analysts:** LTC Timothy E. Trainor, Ph.D., Associate Professor, USMA - Department of System Engineering, 845-938-5534.

**Number of Cadets/Number of Design Teams Involved:** Cadet design team (J. Bonheim, O. Schrang, D. Brewer, B. Green)

**Resources Required for Project:**

**Research Hours Required (by position)**

**Senior Investigator:** 7hrs/wk

**Principal Analyst:** 1 hr/wk

**Total Cadet Time:** 7 hrs/wk/cadet

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Hypersonic Flight Capability & Its Use to Meet Army Missions & Threats**

**Capstone Research Proposal No.: DSE-CR-0510**

**Client Organization:** Army (Scramjet and Cruise Missile Technologies)

## **Point of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Helmut Haas	SAIC	256-864-7048	Helmut.h.haas@saic.com

## **Problem Description:**

Objective Force is a set of functioning elements from which a subset can be formed in real time to carry out missions that can be reasonably foreseen in a general form: peacekeeping, war, antiterrorism, vigilance. The problem of hypersonic flight asks the question of how can COCOM/ Joint Task Forces (Army) utilize hypersonic flight technologies specifically scramjet technology to attack or neutralize time sensitive targets. The solution to the scramjet hypersonic technology should be a feasibility check of the new unit of actions while strongly considering inter-continental ballistic missiles (ICBM).

## **Proposed Work:**

Cadets will interview clients, collect data on experiments on time sensitive targets, create a value hierarchy on alternatives to scramjet technology, determine the legal obligations the Army has to hypersonic flight capabilities, develop a simulation model to determine the path of the projectile, and develop Army vignettes to explain the advantage of utilizing scramjet hypersonic technology in regards to inter-continental ballistic missiles (ICBM). Cadets will encode their work in Excel, Microsoft Project, and other software that is appropriate and deliver test software.

## **Requirements and Milestones:**

- Cadets will report on a weekly basis to their Instructor/Professor.
- Cadets will deliver an interim report at the end of the first semester.
- Cadets will delivery a final report and finished software at the end of April 2005.

## **Project Deliverables and Due Date:**

Deliverables are a simulation model of the scramjet hypersonic technology in regards to ICBM's that can serve military needs for determining the response time, lethality, ideal

projectile path and launch orbit, and other factors to maximize the effectiveness of our Armed Forces and Army vignettes to envision the possible scenarios for which the military can effectively use the scramjet technology in attacking and neutralizing time sensitive targets.

**Senior Investigator:** Dr. Bobbie L. Foote, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893.

**Faculty Analyst:** CPT Gregory Boylan, M.S., Instructor, USMA – Department of Systems Engineering, 845-938-4753.

**Number of Cadets/ Number of Design Teams Involved:** Cadet design team (see capstone team list below as analysts).

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 7 hrs/ wk

**Principle Analyst:** 1 hr/wk

**Total Cadet Time:** 7 hrs/wk/cadet

**DoD Research Thrust:**

**X ORGANIZING – the Force**

**MANNING – the Force**

**TRAINING – the Force**

**X EQUIPPING – the Force**

**FIGHTING – the Force**

**SUPPORTING – the Force**

## **Evaluating the impact of a 10 to 1 increase in required supply chain deliveries**

**Capstone Research Proposal No.: DSE-CR-0511**

**Client Organization:** Plug Power/ERDC/CERL

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
Tom Hartranft	ERDC/CERL	217-373-6713	Thomas.Hartranft@ERDC.usace.army.mil
Paul Burton	Plug Power 968 Albany – Shaker Rd Latham, NY, 12110	518-573-3980	

### **Problem Description:**

Plug Power designs, tests and markets fuel cells powered by hydrogen that produce electricity. Plug Power has installed and maintained fuel cells on 36 different Army/DoD installations since FY01 as part of the DoD Residential PEM Demonstration Program (see list in enclosure). The Army's Construction Engineering Research Lab (CERL) of the Engineering Research and Development Command (ERDC) is the Army's lead for this program. Plug Power is convinced from the demonstration program that they will receive large contracts to support DoD use of fuel cells for power generation on installations. Plug Power is concerned that their production facility/warehouse layout, door capacity and queue buffer for trucks are insufficient to handle large increases in production volume on short notice. If Plug Power receives large DOD/Army orders for their systems (fuel cells also support cell phone towers, and could replace gasoline power generators for base camps as they are quieter), then they may have a 10-1 increase in production and would need to quickly determine feasibility of production plans.

### **Proposed Work:**

Cadets will design and implement a general logistics analyzer to find and solve problems when there is a sudden, big increase in OPTEMPO for a production facility or service provider. The analyzer will incorporate simulation models, deterministic capacity formulas, and expert system checklists. Cadets will interview clients, collect data on warehousing, transportation networks, alternative delivery systems, traffic patterns, and document Plug Power layouts and docks as a test case of the general analyzer. They will then execute the methodology and report solutions to this test case. Cadets will encode their work in MS EXCEL® or other software that is appropriate and deliver a prototype model. This work will support DSE research for base camp development and operation. The knowledge of fuel cells and logistics planning gained through this project can also be

applied in the ORCEN's support to Army research on a lunar base camp design, if the research proposal is accepted.

**Requirements and Milestones:**

- Cadets will report monthly to the client.
- Cadets will deliver an interim report at the end of the first semester.
- Cadets will deliver a final report and software prototype at the end of April 2005.

**Project Deliverables and Due Date:**

Deliverables include a simulation transportation analyzer that can serve military needs for installation re-supply, a set of expert system rules for locating problems when supply has a quantum increase in requirements, a queuing capacity analyzer and an expert rule set for dock capacity. See due dates above.

**Senior Investigator :** Dr. Bobbie L. Foote , Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893.

**Faculty Analyst(s):** CPT Gregory Boylan, M.S., Instructor, USMA – Department of Systems Engineering, 845-938-4753.

**Number of Cadets/Number of Design Teams Involved:** Cadet design team (J. Fritz, D. Rix, B. Drobenak, S. Garcia).

**Resources Required for Project:**

**Research Hours Required (by position)**

**Senior Investigator:** 7 hrs/wk

**Principal Analyst:** 1 hr/wk

**Total Cadet Time:** 7 hrs/wk/cadet

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Integrating Unattended Ground Sensors into the Force**

**Capstone Research Proposal No.: DSE-CR-0512**

**Client Organization:** Army Research Lab, Sensory & Electronic Devices Directorate  
(ARL-SEDD)

## **Points of Contact:**

<b>NAME:</b>	<b>ADDRESS:</b>	<b>PHONE:</b>	<b>OTHER:</b>
Mr. John Eicke	Chief, Signal & Image Processing Division Sensors & Electronic Devices Directorate Army Research Lab ATN: AMSRL-SE-S 2800 Powder Mill Rd Adelphi, MD 20783-1197	301-394-2620	jeicke@arl.army.mil

## **Problem Description:**

Army initiatives include research and development into unattended ground sensors (UGS). UGS will improve the ability of tactical units to collect information. The characteristics of UGS are not yet defined. For example, UGS may be constructed so that each is an inexpensive unimodal sensor that functions in one domain (e.g., acoustic, seismic, magnetic domains only). Multimodal sensors would be more expensive but have more refined ability to detect, classify, and identify targets. Additionally, the quantity, type mix, responsible unit level (e.g., BCT, UA), and doctrinal employment are part of the trade space to optimize sensor value. This study will examine these issues to determine the optimum choices, their robustness, and costs in order to facilitate deployment of UGS to the force.

## **Proposed Work:**

The Systems Engineering and Management Process (SEMP) will be utilized to examine operational considerations of UGS employment. The normal SEMP intermediate products will be generated and presented to the client. A recommendation will be made for optimal deployment and employment parameters.

## **Project Deliverables and Due Date:**

- Interim IPRs: 25 October 2004, 17 November 2004, 10 February 2005.
- Final Briefing: 28 April 2005.
- Project Day Brief: 4 May 2005.

**Senior Investigator:** COL William K. Klimack, Ph. D., Associate Professor, USMA – Department of Systems Engineering, (845) 938-4698, LTC William Bland, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5181 (co-investigator on a related, but separate, topic.)

**Number of Cadets/Number of Design Teams Involved:** Cadet design team: four cadets (2 EM Majors, 1 SE Major, 1 OR FOS).

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 240 Hours.

**Total Cadet Time:** 960 Hours

**Lab Use Hours:** CSL: 100 hours, IM lab: 150 hours.

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Transportation Safety & Risk Assessment (TSRA), FY05 Capstone**

**Capstone Research Project No.: DSE-CR-0513**

## **Client Organization: American International Group, Consultants (AIGC)**

**NOTE:** Pending coordination with military organizations such as ERDC, US Army Safety Center, the Installation Management Agency (IMA) and the US Army Transportation School as potential clients.

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER / EMAIL:
Michael Castelli	Senior VP, Safety AIGC 70 Pine Street New York, NY	212-770-7244	michael.castelli@aig.com

### **Problem Description and Background:**

Cadet capstone work for AIGC in AY03 and AY04 focused on developing a standardized means in which AIGC could quantitatively assess compliance with safety best practices by clients in the ground transportation industry. The overall intent of this work was to identify these best practices from industry and then apply them to a military model for a standardized assessment of safety practices.

Work in AY03 led to a prototype model, the Fleet Operations Safety Assessment Tool (FOSAT), for use in the ground transportation industry. Work in AY04 focused on developing a methodology to evaluate the output data from the FOSAT and use it to prioritize areas of focus for improving safety performance. This also led to a methodology for using FOSAT data as a means to forecast future safety performance metrics based on improvement in overall safety score as measured by the FOSAT.

Proposed work for AY05 is to develop a military-specific application of the FOSAT, beta test it in select military transportation organizations, and evaluate and assess the resulting data for use as a predictor of future safety performance. AIGC can use this military beta test as a proof of concept for the industry-version of this transportation safety risk assessment model. Applying the model to the military gives AIGC the raw data they need to determine whether it can be easily applied to other industries. Results from this proof of concept will be used to improve the industry version, and to develop a standardized means to assess and predict safety performance in organizations involved with military ground transportation. The military version of the FOSAT will be dubbed the TSRA tool as described in the project name.

### **Proposed Work:**

This work will use actual Army units to collect data and validate the military application of the FOSAT (TSRA). The project team will develop the TSRA, collect data in a database from use of the TSRA via the internet, and evaluate the data using Microsoft EXCEL tools. The project team will use lessons learned from this beta test to improve the TSRA and refine the Fleet Operations Safety Assessment Tool (FOSAT). Data from the TSRA will be used to validate / refine the safety forecasting methodology developed for the FOSAT.

Specifically, the proposed work for TSRA includes:

- Research the FOSAT model and modify it for military use as the TSRA.
- Create a web-based TSRA model in order to collect data via the Internet.
- Beta test the TSRA with select military transportation units.
- Collect and analyze data and feedback from the users.
- Use model to analyze strengths and weaknesses of the units in safety practices.
- Use analysis to forecast future performance in safety metrics using the FOSAT methodology.
- Report back to AIGC on the robustness of the FOSAT concept to quantitatively assess safety practices and forecast safety performance.
- Use results to modify the FOSAT, the industry version of this model.

### **Requirements and Milestones:**

- The primary milestones are:
  - Completion of the Military Application of FOSAT
  - Testing the application
  - Analyzing the data
  - Reporting results and modifying the FOSAT

### **Deliverables:**

- Completed TSRA model – End of October 2004
- Functional Web Model of TSRA – Mid December 2004 (end of semester)
- Useful, interpretable data collection – Mid February 2005
- Ability to ID strengths & weaknesses w/in safety – Mid April 2005
- Report of results and integration of lessons learned for use by AIGC – mid May 2005

**Senior Investigator:** LTC Timothy E. Trainor, Ph.D., Assistant Professor, USMA –  
Department of Systems Engineering, 845-938-5534.

**Number of Cadets Involved:** 5 Cadets: 3 EM Majors, 1 OR Major, 1 SE Major.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator/Faculty Analyst:** 1 hr/wk x 52 weeks = 52 hours

**Total Cadet Time:** 4 hrs/wk x 5 cadets = 20 hours/week x 36 weeks = 720  
hours.

**Lab Use Hours:** 400 hrs

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **Bradley Medium Caliber Cannon Study**

**Capstone Research Proposal No.: DSE-CR-0514**

**Client Organization:** Project Manager Ground Combat Systems

### **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
COL Larry Hollingsworth	Project Manager-Ground Combat Systems Warren, Michigan	(586) 574-6630	hollingl@tacom.army.mil

### **Problem Description:**

To determine the optimum main gun for the Bradley Fighting Vehicle System through the year 2032. The gun provides lethality for the system and bore diameter is particularly important for chemical energy warheads. However, larger gun calibers reduce the capacity to store ammunition and in general have slower rates of fire. Changing the present gun system also increases costs. Given these factors, an optimum gun system will be recommended based on existing candidate systems. System lethality requires that targets can be acquired, identified, engaged, and suppressed or destroyed. Areas requiring continuing research and study include: various mission profiles and environments, acquisition mechanisms, gun caliber and rate of fire, target effects and range, ammunition types and technological risks, among many others. Today's medium caliber cannon (25mm) in the current combat Infantry Brigade configuration will be examined and compared with the new modular Unit of Action (Brigade Combat Team), in which there are less Bradleys. This comparison will be made with the 25 mm then the candidate cannons: 30mm, 35mm, 40mm, 40mm CTAI, and 50mm. Can the reduction of Bradley Infantry Fighting Vehicles and corresponding firepower be compensated by the increase in medium caliber cannon lethality?

### **Proposed Work:**

The medium caliber cannon alternates will be evaluated using Army Material Systems Analysis Activity (AMSAA) classified data derived from testing and analysis of the candidates and modeled using JCATS software. Combat simulation results are analyzed using Jets software in multiple combat scenarios: to include Southwest Asia, Korea Europe and urban terrain. The Systems Engineering Management Process will be employed to determine the cannon that will provide the highest value to the client. A screening experiment will first be accomplished in order to determine significant factors. A practical analysis will ensue with cadet design teams using the theoretical approach applied to realistic systems.

**Project Deliverables and Due Date:**

- Interim IPRs: Expected dates, December 2004.
- Final Briefing: Due date, May 2005.
- Technical Report: Due date, May 2005.

**Senior Investigator:** COL William K. Klimack, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4698, LTC Simon Goerger Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-4799.

**Faculty Analyst(s):** CPT Gregory Boylan, M.S., Instructor, USMA - Department of Systems Engineering, 845-938-4753, MAJ Patrick Downes, M.S., Assistant Professor, USMA - Department of Systems Engineering, 845-938-3114, MAJ Thomas Rippert, M.S., Assistant Professor, USMA - Department of Systems Engineering, 845-938-5578.

**Number of Cadets/Number of Design Teams Involved:** Cadet design team (1 EM Major, 2 SE Majors, 1 ISE Major, 1 OR Major).

**Supporting Laboratory Technician:** Mr. John Melendez

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** COL William Klimack: 120 Hours, LTC Simon Goerger: 40 Hours: 20 hours.

**Principal Analyst:** CPT Boylan: 50 hours; MAJ Patrick Downes, 150 Hours; MAJ Thomas Rippert: 50 hours.

**Lab Technician:** 40 Hours

**Total Cadet Time:** 200 Hours per cadet or 800 hours

**Lab Use Hours:** Classified Lab: 100 hours, IM lab: 150 hours.

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Modeling Human Behavior in Synthetic Environments**

**Capstone Research Proposal No.: DSE-CR-0515**

**Client Organization:** PM OneSAF

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
LTC Buck Surdu Product Manager	US Army PEO STRI 12350 Research Pkwy Orlando, FL 32826-3276	407-384-5103 DSN 970-5103	John.Surdu@us.army.mil

## **Problem Description:**

A significant gap exists between current and desired capabilities for representing human behaviors such as morale and leadership in Army combat simulations. The Program Manager for the Objective OneSAF simulation (OOS) and other simulation proponents desire a methodology for identifying and integrating behaviors in simulation and for assessing their added value to both constructive and virtual simulation analysis.

## **Proposed Work:**

The Department of Systems Engineering will develop a methodology for modeling selected human behaviors, targeting the Objective OneSAF simulation. Specifically, DSE will:

- Identify and prioritize current and desired human behaviors in OOS.
- Generate alternatives for low and high-fidelity behavior representation.
- Prototype one or more of the alternatives in coordination with stakeholder needs.
- Develop an analytical framework for evaluating behaviors.

**Requirements and Milestones:** TBD

## **Project Deliverables and Due Date:**

- Interim IPRs: October, December, 2004; January, March, 2005
- Final Briefing: May 2005
- Technical Report: June 2005

**Senior Investigator:** Dr. Paul D. West, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-5871.

**Number of Cadets/Number of Design Teams Involved:** 4/1: (CDTs A. Creel, S. Jennings, A. Figer, B. Schnitker)

**Supporting Laboratory Technician:** Mr. John Melendez

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 200 hours

**Lab Technician:** 8 hours

**Total Cadet Time:**  $240 \times 4 = 960$  hours

**Lab Use Hours:** AMSD, 200 hours

**Laboratory Technician Hours:** 32 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## BCT Supportability Modeling

**Capstone Research Proposal No.: DSE-CR-0516**

**Client Organization:** PM Unit of Action Logistics Integration Directorate

### Points of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Nancy Moulton, Director, Logistics Integration	Logistics Integration Directorate PM, Unit of Action 6000 6th St, Suite 100, Bldg 1464 Ft. Belvoir, VA 22060	586-909-0217	Nancy.a.moulton@us.army.mil
Michael Alter, Operations Manager	Logistics Integration Directorate PM, Unit of Action 6000 6th St, Suite 100, Bldg 1464 Ft. Belvoir, VA 22060	703-806-2052 703-994-1563 (mobile)	Michael.alter@belvoir.army.mil

### Problem Description:

Supportability modeling for the emerging Brigade Combat Team (formerly Unit of Action) is in its early stages. Metrics are required to ensure that models and simulations (M&S) provide useful analytical results to support logistics integration in the BCT. The client directorate desires a cooperative assessment of the state-based Operational Availability (AO) model under development by Sandia National Laboratories, to include an analysis of alternative model inputs and parameters, as well as a formulation of metrics for M&S output.

### Proposed Work:

The Department of Systems Engineering will support the PM UA in assessing its BCT supportability M&S effort. Specifically, DSE will:

- Conduct a functional analysis of BCT supportability.
- Review and assist in validating the Operational Availability model under development.
- Develop metrics for assessing BCT Operational Availability, Life Cycle Costs, and Logistics Footprint.
- Evaluate model outputs and make recommendations for improvements to the model.

**Requirements and Milestones:** TBD (possible extension 1-3 years, including future AIADs)

**Project Deliverables and Due Date:**

- Interim IPRs: October, December, 2004; January, March, 2005
- Final Briefing: May 2005
- Technical Report: June 2005

**Senior Investigator:** Dr. Paul D. West, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-5871.

**Faculty Analyst(s):** None

**Number of Cadets/Number of Design Teams Involved:** 5 / 1: (CDTs D. Acker, D. Starling, E. Ingram, B. Vincent, J. Desenna)

**Supporting Laboratory Technician:** Mr. John Melendez

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator:** 200 hours

**Lab Technician:** 8 hours

**Total Cadet Time:**  $240 \times 5 = 1200$  hours

**Lab Use Hours:** AMSD, 200 hours

**Laboratory Technician Hours:** 32 hours

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

# **Analysis of Alternatives for Arming UAVs (formerly UAV Support to the Company)**

**Capstone Research Proposal No.: DSE-CR-0517**

**Client Organization:** PEO Aviation, Redstone Arsenal, AL

## **Points of Contact:**

NAME:	ADDRESS:	PHONE:	OTHER:
COL John D. Burke	Project Manager, Tactical Unmanned Aerial Vehicle Systems PEO Aviation Redstone Arsenal, AL 35898	256-895-4449	burkejd@tuav.redstone.army.mil
Mr. Jim Charlton	TUAVS PEO Aviation Redstone Arsenal, AL 35898	256-895-4365	jim.charlton@tuav.redstone.army.mil

## **Problem Description:**

Compare two alternatives for tactical unmanned aerial vehicle (UAV) support at the company level: (1) A single battalion-level tactical UAV assigned in direct support to a company as required, with mission control after launch at the company level; (2) Hand-launched small UAVs launched and operated by each company. NB—This is a follow-on to a continuing line of investigation on UAV analysis; the exact problem investigated this year may change based on PEO needs.

## **Proposed Work:**

- Evaluate the problem and identify appropriate measures of performance
- Identify and gather data on candidate systems
- Develop parameter-based spreadsheet model to calculate measures
- Compare alternatives and make recommendation

**Requirements and Milestones:** TBD

## **Project Deliverables and Due Dates:**

- IPRs: Oct 04; Dec 04; Feb 05
- Final Briefing: Apr 05
- MORSS Presentation: Jun 05
- Technical Report: Aug 05

**Senior Investigator:** Dr. Roger C. Burk, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4754.

**Number of Cadets/Number of Design Teams Involved:** One cadet design team of four cadets: two Operations Research majors, one Systems Engineering major, and one Engineering Management (Mechanical Engineering) major.

**Resources Required for Project:**

**Research Hours Required (by position):**

**Senior Investigator/Principal Analyst:** 136 hours (4 hrs/wk for 2 semesters)

**Total Cadet Time:** 1200 hours (4 cadets for 2 semesters)

**DoD Research Thrust:**

- ORGANIZING – the Force**
- MANNING – the Force**
- TRAINING – the Force**
- EQUIPPING – the Force**
- FIGHTING – the Force**
- SUPPORTING – the Force**

## **PART XI - Distribution List**

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Assistant Secretary of the Army (I&E)	The Pentagon, Room 2E614 Washington, DC 20310	1
Assistant Secretary of the Army (Acquisition, Logistics & Training)	The Pentagon, Room 2E672 Washington, DC 20310	1
Deputy Assistant Secretary of the Army (Resource Analysis & Business Practices)	The Pentagon, Room 3E572 Washington, DC 20310	1
Deputy Under Secretary of the Army (Operations Research), HQDA	ATTN: DUSA(OR), The Pentagon, Room 2E660 Washington, DC 20310-0102	2
Assistant Chief of Staff, Installation Management	ACSIM, HQDA The Pentagon, Room 1E668 Washington, DC 20310	2
Director of the Army Budget	The Pentagon, Room 3A662 Washington, DC 20310	1
Deputy Director Program Analysis & Evaluation	HQDA, The Pentagon, Room 3C718 Washington, DC 20310-0200	1
Director USA Concepts Analysis Agency	8120 Woodmont Avenue Bethesda, MD 20814-2797	1
Director U.S. Army Research Office	ATTN: AMSRL-RO-EM P.O. Box 12211 Research Triangle Park, NC 27709-2211	1
Deputy Director Advanced Systems Concepts Office	US Army ARDEC Picatinny Arsenal, NJ 07806-5000	1
Technical Director Operational Test and Evaluation Command (OPTEC)	Park Center IV 4501 Ford Avenue, Suite 1420 Alexandria, VA 22302	1
Assistant Deputy Chief of Staff for Doctrine, HQ TRADOC	ADCS DOC ATTN: ATDO-ZA Ft. Monroe, VA 23651-5000	1
Director TRADOC Analysis Command (TRAC)	255 Sedgwick Ave. Ft. Leavenworth, KS 66027-5200	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Director TRADOC Analysis Center (TRAC)	PO BOX 8692 Monterey, CA 93943	1
Director TRADOC Analysis Command-WSMR	ATTN: ATRC-W White Sands Missile Range, NM 88002-5502	1
Director TRAC Joint Forces Command J9 Support Team	1562 Mitscher Avenue Norfolk, VA 23551-2488	1
Director Training Support Assistance and Integration Directorate	Army Training Support Center Bldg #1728 – Patton Avenue Ft. Eustis, VA 23604	1
US Army Training Support Center Training Support Assistance and Integration Directorate, Asst. Div.	ATTN: ATIC-SAIA-AN Bldg #1529 Ft. Eustis, VA 23604	1
Commander National Ground Intelligence Center	220 7 <sup>th</sup> Street, N.E. Charlottesville, VA 22902-5396	1
Commander US Army Nuclear & Chemical Agency	7500 Backlick Road – Bldg #2073 Springfield, VA 22150	1
Commander US Army Operational Evaluation Command	4501 Ford Avenue Alexandria, VA 22302-1458	1
Commander US Army Test & Evaluation Command	4501 Ford Avenue Alexandria, VA 22302-1458	1
Commander US Army Recruiting Command	ATTN: RCPAE Ft. Knox, KY 40121	1
Commander US Army Space & Missile Defense Command	1941 Jefferson Davis Highway Suite 900 Arlington, VA 22215-0280	1
Director Army Research Laboratory	2800 Powder Mill Road Adelphi, MD 20783- 1145	1
Director, ARL – Sensors & Electronic Devices Directorate	ATTN: AMSRL-SE-S 2800 Powder Mill Road Adelphi, MD 20783-1197	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Director Center for Army Analysis	6001 Goethals Road Ft. Belvoir, VA 22060-5230	1
Director Information Systems for Command, Control, Communications & Computers	107 Army Pentagon Washington DC 20310-0107	1
Director Program Analysis & Evaluation, OCSA	200 Army Pentagon Washington, DC 20310-0200	1
Director Strategic Studies Institute	US Army War College Carlisle Barracks, PA 17013	1
Dean Naval Postgraduate School	1 University Circle Monterey, CA 93943	1
Dean Air Force Institute of Technology	2950 Hobson Way WPAFB OH 45433-7765	1
Dean Command & General Staff College	Ft. Leavenworth, KS	1
Director US Army Cost & Economic Analysis Center	1421 Jefferson Davis Highway Suite 9000 Arlington, VA 22202	1
Director US Army Material Systems Analysis Activity	Aberdeen Proving Ground, MD 21005-5071	1
Director US Army National Simulation Center	ATTN: ATZL-NSC 410 Kearney Avenue – Building 45 Ft. Leavenworth, KS 66027-1306	1
Director US Army Research Institute for Behavioral and Social Sciences	5001 Eisenhower Avenue Alexandria, VA 22333	1
Director US Army Waterways Experimentation Station	3909 Halls Ferry Road Vicksburg, MS 39180	1
CDR, USA ARMC	ATTN: ATZK-MW Ft. Knox, KY 40121-5000	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Comdt, USAIS	ATTN: ATZB/WC Ft. Benning, GA 31905-507	1
Comdt, USAFAS	ATTN: ATSF-CBL Ft. Sill, OK 73503-5600	1
Cdr, USACAC	ATTN: ATZL-CDB Ft., Leavenworth, KS 66027-5300	1
Cdr, USASC (Signal Center)	ATTN: ATZH-BL Ft. Gordon, GA 30905-5299	1
Cdr, USAIC&FH (Intel Center)	ATTN: ATZS-FDB Ft. Huachuca, AZ 85613-6000	1
Cdr, USACASCOM	ATTN: ATCL-B Ft. Lee, VA 23801-6000	1
HQ USAMANSCEN & Ft. Leonard Wood	ATTN: ATZT-MSBL Ft. Leonard Wood, MO 65473-6620	1
Cdr, USAAVNC	ATTN: ATZQ-ABL Ft. Rucker, AL 36362-5000	1
Cdr, USASMDC	ATTN: SMDC-BL P.O. Box 1500 Huntsville, AL 35807-3801	1
Cdr, USARSPACE	ATTN: SMDC-BL-W 1670 North Newport Road Colorado Springs, CO 80916-2749	1
Comdt, USAADASCH	ATTN: ATSA-CDB 5800 Carter Road Ft. Bliss, TX 79916-3802	1
Cdr, USATRADOC	ATTN: ATCD-B Ft. Monroe, VA 23651-5000	1
Battle Command Ft. Leavenworth Cdr, USACAC	ATTN: ATXH-BLT Ft. Leavenworth, KS 66027- 5300	1
Depth & Simultaneous Attack Comdt, USAFAS	ATTN: ATSF-CBL Ft. Sill, OK 73503-5600	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Battle Command Ft. Gordon Cdr, USASC&FG	ATTN: ATZH-BLT Ft. Gordon, GA 30905-5294	1
Mounted Battle Space Cdr, USAARMC	ATTN: ATZK-MW Ft. Knox, KY 40121-5000	1
Battle Command Ft. Huachuca Cdr, USAIC&FH	ATTN: ATZS-CDT Ft. Huachuca, AZ 85613-6000	1
Dismounted Battle Space Comdt, USAIS	ATTN: ATSH-IWC Ft. Benning, GA 31905-5007	1
Combat Service Support Cdr, USACASCOM	ATTN: ATCL-C Ft. Lee, VA 23801-6000	1
Early Entry Lethality and Survivability Cdr, USATRADOC	ATTN: ATCD-L Ft. Monroe, VA 23651-5000	1
Battle Lab Integration & Technology Directorate Cdr, USATRADOC	ATTN: ATCD-L Ft. Monroe, VA 23651-5000	1
Command General US Army Materiel Command (AMC)	AMCCG Bldg 1464 Fort Belvoir, VA 22060	1
PM-Logistics Information Systems (LIS)	800 Lee Avenue Fort Lee, VA 23801-1718	1
PM Lead The Fleet (LTF) Army Test & Evaluation	AMRDEC, US Army RDECOM AMSAM-RD, Bldg. 8716 Redstone Arsenal, AL 35898	1
Commander US Joint Forces Command	1562 Mitscher Ave. Suite 200 Norfolk, VA 23551	1
Deputy Chief of Staff for Personnel Army G-1	300 Army Pentagon Washington, DC 20310-0300	1
Deputy Chief of Staff Training & Leader Development Directorate Army G-3	300 Army Pentagon Washington, DC 20310-0300	1
Deputy Chief of Staff for Logistics Army G-4	300 Army Pentagon Washington, DC 20310-0300	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Commander US Army Recruiting Command (USAREC)	ATTN: RCPAE 1307 Third Avenue Ft. Knox, KY 40121-2726	1
Commander US Army Accessions Command (USAAC)	90 Ingalls Road – Bldg. 100 Ft. Monroe, VA 23651	1
Director Defense Advanced Research Project Agency (DARPA)	3701 North Fairfax Drive Arlington, VA 22203-1714	2
Program Executive Officer (PEO) Soldier	5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	1
TACOM-ARDEC	AMSTA-AR-TD Bldg 1, 3rd Floor Picatinny Arsenal, NJ 07806-5000	1
Director Operational Test Command (OTC)	Aviation Test Directorate Ft Hood, TX 76544	1
Director Defense Modeling & Simulation Office	1901 N. Beauregard Street, Suite 500 Alexandria, Virginia, 22311-1705, USA	1
Project Manager - Unmanned Aerial Vehicles	PEO Aviation Redstone Arsenal, AL	1
Director, HEL Joint Technology Office	901 University Boulevard SE – Suite 100 Albuquerque, NM 87106	1
Chief Resource Analysis and Integration Office Army G-3	HQDA- DCSOPS (DAMO-ZR) 400 Army Pentagon Washington, DC 20310-0400	1
Chief, Deployability Division	MTMCTEA 720 Thimble Shoals Blvd. Newport News, VA 23606-2574	1
BG Daniel Kaufman Dean of the Academic Board	MADN USMA, Bldg 600, Room 107 West Point, NY 10996	1
Dr. Stephen Landowne, Associate Dean, Academic Research Division	MADN-ARD USMA, Bldg 600, Room 15 West Point, NY 10996	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
COL Michael L. McGinnis, Ph.D. Professor and Head	MADN-SE D/Systems Engineering, USMA West Point, NY 10996	2
COL Gary Krahn, Ph.D. Professor and Head	MADN-MATH D/Mathematical Sciences, USMA West Point, NY 10996	1
LTC Michael J. Kwinn, Jr., Ph.D., Director Operations Research Center for Excellence	MADN-ORCEN USMA, Bldg 752 – Room 305 West Point, NY 10996	5
Director, Information Technology & Operations Center	MADN-ITOC USMA, Bldg 601, Room 111 West Point, NY 10996	1
Director, Office of Economic & Manpower Analysis	MADN-OEMA USMA, Bldg 607, Room 109 West Point, NY 10996	1
Director, Photonics Research Center	MADN-PRC USMA, Bldg 753, Room B21 West Point, NY 10996	1
Director, Mechanical Engineering Research Center	MADN-MERC USMA, Bldg 752, Room 104 West Point, NY 10996	1
Director, Civil Engineering Research Center	MADN-CERC USMA, Bldg 752, Room 103 West Point, NY 10996	1
Director, Mathematical Sciences Center of Excellence	MADN-MSCE USMA, Bldg 601, Room 226A West Point, NY 10996	1
Director Center for Technology-Enhanced Language Learning	MADN-CTEL USMA, Bldg 745, Room W5100 West Point, NY 10996	1
Director, Center for Teaching Excellence	MADN-CTE USMA, Bldg 601, Room 119 West Point, NY 10996	1

<b>ORGANIZATION</b>	<b>ADDRESS</b>	<b>COPIES</b>
Director, Center for Molecular Sciences	MADN-CMS USMA, Bldg 753, Room 411 West Point, NY 10996	1
Director, Leader Development Research Center	MADN-LDRC USMA, Bldg 601, Room 267 West Point, NY 10996	1
Director, Center for Enhanced Performance	MADN-CEP USMA, Bldg 745a, Room W6309 West Point, NY 10996	1
Director, Center for Environmental & Geographical Sciences	MADN-CEGS USMA, Bldg 745, Room W5412 West Point, NY 10996	1
	<b>TOTAL</b>	<b>104</b>